DOCUMENT RESUME

ED 293 371 FL 017 353

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TITLE 8th Grade Physical Science Units Modified for ESOL Students, Middle School.
INSTITUTION Prince George's County Public Schools, Upper Marlboro, Md.
PUB DATE 18 Nov 87
NOTE 170p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS *Chemistry; Class Activities; *English (Second Language); Grade 8; Instructional Materials; Junior High Schools; Laboratory Procedures; *Limited English Speaking; *Physics; *Science Curriculum; *Scientific Concepts
IDENTIFIERS *Prince Georges County Public Schools MD

ABSTRACT

A packet of supplementary materials for eighth grade science instruction for limited-English-proficient students is intended for beginning and intermediate students of English as a second language (ESOL). It contains worksheets and activities designed to increase student participation, challenge them within their language ability, create positive learning experiences, and be used with the entire class for both content and concept material. The activities assist in the development and reinforcement of content language skills while requiring minimal amounts of individual instruction. Four units are included, covering the philosophy of science, basic science skills and techniques, chemistry, and physics. Each unit contains a series of two to 14 subunits consisting of content-related exercises. The exercise types include fill-in-the-blank, identification, crossword puzzles, matching, and deductive thinking activities. (MSE)

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ED293371

# BULLETIN

PRINCE GEORGE'S COUNTY PUBLIC SCHOOLS

I-57-88
Originators Serial No.

November 18, 1987
Date

Instruction
Originating Office

Retain for Reference
Cancellation Date

TO: Middle School Principals
Middle School Science Teachers

FROM: Associate Superintendent for Instruction

SUBJECT: 8th Grade Physical Science Units Modified for ESOL Students (7690-1718)

1. PURPOSE: To distribute 8th Grade Physical Science Units Modified for ESOL Students.

2. INFORMATION: These units were developed to provide the eighth grade science teacher with supplemental materials for teaching beginning and intermediate ESOL students. There are a variety of worksheets and activities to increase participation of Limited English Proficient students in the class, to challenge within their language ability, to create positive learning experiences, to be usable with the entire class for both concept and content material. These materials should assist in the development and re-enforcement of content language skills while requiring minimal amounts of individual instruction.

   Four units are presented in this packet:

   (1) Philosophy of Science
   (2) Eighth Grade Physical Science Basic Skills
   (3) Chemistry
   (4) Physics

   As teachers use this curriculum supplement, they are invited to share their experiences, concerns and suggestions for improvement or revision. Please encourage them to provide feedback to the science supervisors or the ESOL Coordinator.

3. FILING INSTRUCTIONS: Retain for reference.

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Louise F. Waynant
Associate Superintendent for Instruction

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# 8th GRADE PHYSICAL SCIENCE UNITS

# MODIFIED FOR ESOL STUDENTS

# MIDDLE SCHOOL

Prince George's County Public Schools
Upper Marlboro, Maryland 20772
1987

7690-1718

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A grateful acknowledgment to Hollis G. Stein, ESOL Diagnostician for her assistance in this project.

This guide was partially funded by Title VII - Special Alternative Instructional English Project in English, K-12.

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# INTRODUCTION

This handbook is intended to assist physical science teachers in secondary schools who are working with ESOL students. The purpose is to provide the teacher with activities that would:

1. increase class participation
2. create positive experiences within the mainstreamed classroom
3. be challenging but not beyond the language ability of the students
4. require minimal amounts of individual instruction
5. be usable with the entire class for both concept and content material
6. develop and reinforce the content language skills of the students.

All materials are correlated with the topical outline as presented in the eighth grade Physical Science Curriculum Guide. Activities are developed around the major area headings of Philosphy of Science, Basic Skills, Chemistry, Energy, and Physics. These are intended as reinforcement materials for information previously presented in the classroom. They are designed to assist the student to understand in simplified terms both the underlying philosophy of scientific research and some basic concrete knowledge of the subject areas addressed.

As with any subject, the teacher's own ideas and creativity should be used to incorporate the suggested supplemental materials into an effective learning experience. While the ESOL student is not to be isolated in the classroom, pairing an interested and supportive American student with an individual ESOL student to clarify a classroom lecture will provide useful support to the ESOL student. Simplified explanations for reinforcement should always be available for the beginning ESOL student, and are usually helpful for the intermediate level ESOL student.

## USE OF THIS GUIDE

The variety of worksheets included in this packet should be viewed as models of the types of activities that best reinforce the learning experience for ESOL students. Exercises include matching vocabulary words to the definition, alphabetizing vocabulary, looking up words in the glossary or dictionary, matching equipment to a description of its use, crossword puzzles, sentence completion, and fill in the blank (cloze stories). The ESOL student is at a very basic level of vocabulary development and may need to choose the correct items from a list or series of words or from pictures, rather than be expected to recall science vocabulary from memory. There is a great dependence on visual clues with clear but simplified science vocabulary. Technical vocabulary acquisition is a slow process. Word comprehension can be illustrated by the following example:

The Paragraph as it appears in Chemistry Workshop -1:

A compound is a substance made of linked-up atoms. The elements in the compound lose their own properties. The compound takes on new properties. Compounds do not even have to be in the same state as the elements of which they are made. For example, hydrogen and oxygen are both gases. They can link up to make water - a liquid. A compound must have at least one metal element and one nonmetal.

To illustrate what an ESOL student can understand when they read, unfamiliar vocabulary has been deleted in the following paragraph.

A BEGINNING ESOL STUDENT:

A _____ is a _____ made of _____ _____. The _____ in the _____ _____ their _____ _____. The _____ _____ ___ new _____. _____ do not _____ have to be in the same _____ as the _____ of _____ they are made. For _____, _____ and _____ are both _____. They can _____ up to make water - a _____. A _____ must have at _____ one _____ _____ and one _____.

AN INTERMEDIATE ESOL STUDENT:

A compound is a _____ made of _____ atoms. The _____ in a compound lose their own _____. The compound takes on new _____. Compounds do not even have to be in the same _____ as the _____ of which they are made. For example, _____ and _____ are both _____. They can _____ up to make water - a liquid. A compound must have at _____ one _____ and one _____.

The ESOL student should be a participant in all experiments, with the teacher aware that the student can understand a hands-on experience much more readily than a reading assignment. In the interest of lab safety, however, it is important to pair with an American classmate familiar with the names of materials being used to help assure that lab errors from using incorrect materials or procedures will be miminized.

## THE ESOL STUDENT

ESOL students may have difficulty adjusting to their new environment for the following reasons:

- Students are at widely different levels of English proficiency and knowledge.
- Students may not be aware of accepted behavioral patterns within the school and classroom. This may be their first school experience.
- Students who have studied English in their own country with non-native English speaking teachers are frequently deficient in listening comprehension and speaking skills. They can often read and write far better than they can understand and communicate orally.
- Students may have difficulty making friends with American students. This tends to make them feel more isolated and compounds adjustment difficulties.
- Students may have difficulties participating in extra-curricular activities due to problems with communication and transportation or unfamiliarity with after-school programs.
- Students may come into cultural conflict with their families as they begin to make cultural adjustments at school and with American peers.
- Students may work after school limiting the time available for study.

## SUGGESTIONS FOR TESTING ESOL STUDENTS

Beginning students may range from those of very little oral proficiency, who are unable to function in the spoken language to the intermediates who are able to maintain a simple face to face conversation on familiar topics.

In light of this and the likely vocabulary and reading deficiencies exhibited by ESOL students, these alternative test approaches are suggested:

1. Item identification either oral and/or written, such as matching.
2. Vocabulary or sentence jumbles.
3. Multiple choice items using familiar vocabulary.
4. Oral questions requiring short answers.
5. Pictorial sequencing.
6. Cloze or Completion using familiar vocabulary.
7. Answering written questions based on readings using familiar vocabulary.

# UNIT I

# PHILOSOPHY OF SCIENCE

## PHILOSOPHY OF SCIENCE

### GENERAL STATEMENT

The activities in this section are designed to expose ESOL students to the scientific mode of operations. The behavioral objectives from the eighth grade Physical Science Curriculum Guide that are dealt with in these activities include:

1. Define science as a search for knowledge.

2. Explain that the scientific method is a logical process which can be used by any person.

3. Explain that professional scientists are "real" people who make a living utilizing the scientific method; they are neither magicians, gods, nor mysterious beings.

4. Use senses to observe natural phenomena and describe the observations as clearly and accurately as possible.

5. Develop skills in recognizing valid problems, assessing variables, evaluating previous data, and speculating on possible hypotheses.

6. Formulate conclusions that support, reject, or modify a hypothesis based only on data collected.

7. Communicate information on an experiment using scientific form and terminology.

8. Differentiate between the results of pure science (knowledge) and applied science (technology).

9. Interpret superstition as a possible fact that does not apply under generalized circumstances, and understand the application of the scientific method in separating fact from superstition.

These objectives underscore a basic philosophy that the study of physical science is informed inquiry that is orderly, logical, and observable. It is a search for knowledge and understanding of the physical world by means of observation, experimentation, and evaluation.

# THE SCIENTIFIC METHOD

WORDS TO KNOW:

1. Title
2. Purpose
3. Hypothesis
4. Materials
5. Procedure
6. Control
7. Variable
8. Results and Observations
9. Data
10. Conclusion
11. Investigation

1. Title - The title is the subject (topic) of the Investigation. It tells what you want to know.
   Example: Sound Travel or To See If Sound Travels Through Air.

2. Purpose - The purpose tells what you want to find out.
   Example: Does sound travel through air?

3. Hypothesis - The hypothesis is what you think will happen. It is something you can test to see if it is true or not true.
   Example: Sound travels through air.

4. Materials - Materials are things you need to use.
   Example: A bell, a whistle, and a drum are materials.

5. Procedure - The procedure is what you do, step by step.

6. Control - A control is something that does not change. It is the standard by which the variable is judged.

7. Variable - A variable is the part of the experiment that is the test. It is something that changes.

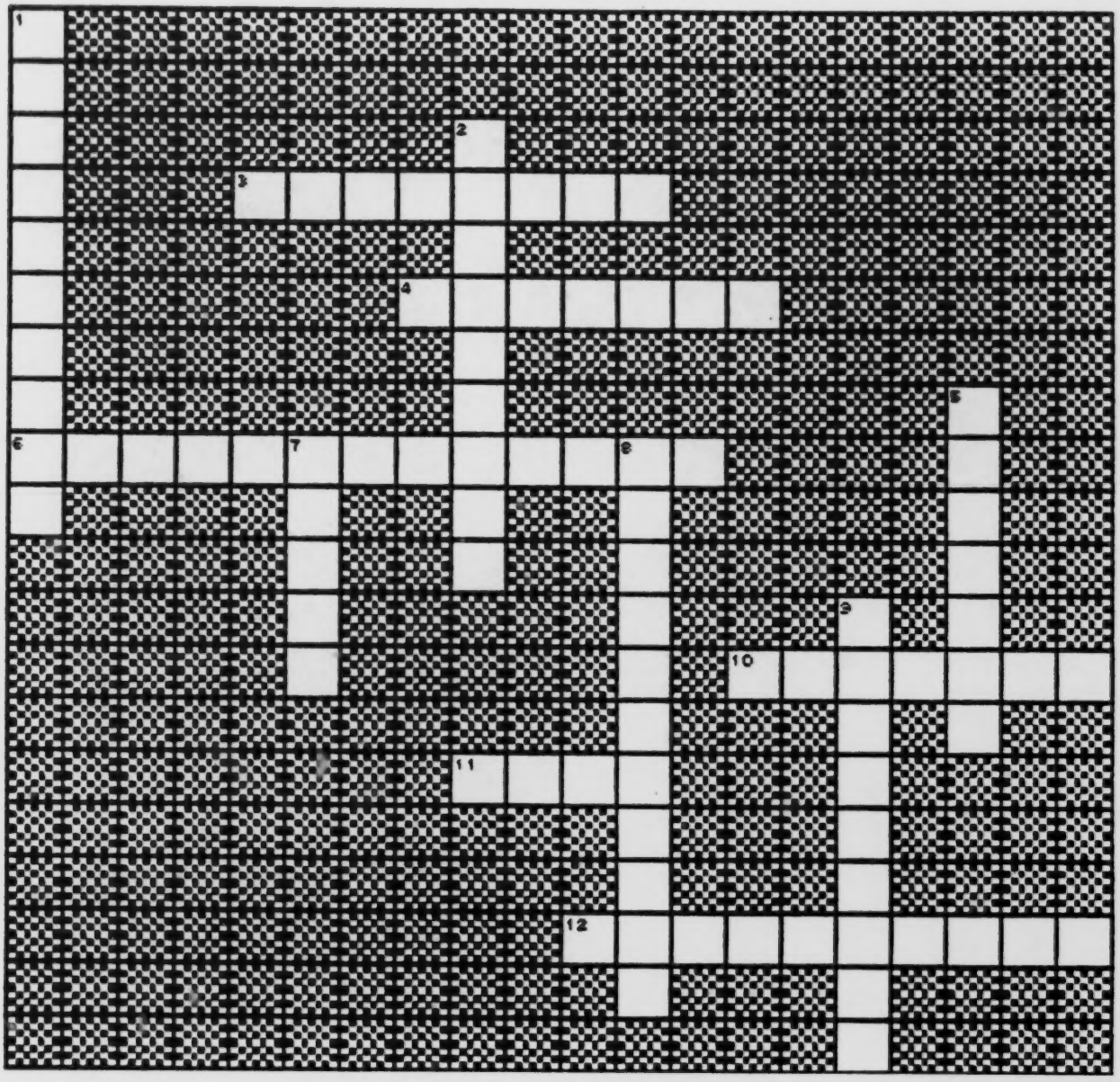
8. Results and Observation - The results are what you see happen.

9. Data - Data is what you write about what happens. It is the information you collect from the experiment, usually in number form.

10. Conclusion - A conclusion tells if your hypothesis is true or false.
    Example: Yes, my hypothesis is true. Sound travels through air.
    No, my hypothesis is false. Sound does not travel through air.

11. Investigation - An investigation is how to find the facts.

# THE SCIENTIFIC METHOD



ACROSS CLUES

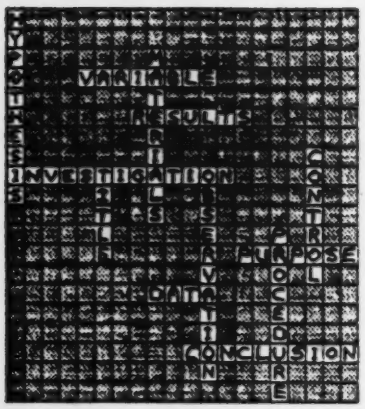
3. Something that changes
4. Data of what happens
6. How to find the facts
10. Tells what you want to find out.
11. Information. What happened in the experiment.
12. Tells if your hypothesis is true or false.

DOWN CLUES

1. What you think will happen in an experiment.
2. Things you will need to do the experiment.
5. Something that does not change
7. The subject of the investigation
8. Results that you see happen during an experiment.
9. The steps you will do to do the investigation or experiment.

THE SCIENTIFIC METHOD

ANSWER KEY:



Name _____

# THE SCIENTIFIC METHOD

## Activity I - Identifying a Title

Read each set of words and put a T for Title.

Example: ____ Does Sound Travel Through Air?
T Sound Travels Through Air.

1. _____ Does Sound Travel in Water?

   _____ Sound Travels in Water.

2. _____ Sound Travels in The Dark.

   _____ Does Sound Travel in The Dark?

3. _____ Does Air Make Sound?

   _____ Air Makes Sound.

4. _____ Do Drums Make Sounds?

   _____ Drums Make Sounds.

5. _____ Sounds Are Made By a Whistle.

   _____ Are Sounds Made By a Whistle?

Name _____

THE SCIENTIFIC METHOD

Activity II - Writing a Purpose

Rewrite each title as a purpose.

Example: Title - Sound Travels Through Air.

Purpose - To see if sound travels through air.

1. Title - Sound Travels in Water.

   Purpose - To see if _____

2. Title - Sound Travels in The Dark.

   Purpose - To See if _____

3. Title - Air Makes Sounds

   Purpose - _____

4. Title - Drums Make Sounds

   Purpose - _____

5. Title - Sounds Are Made by A Whistle.

   Purpose - _____

 Name _____

## EVIDENCE - DIRECT AND INDIRECT

Remember:

evidence - something that furnishes proof, observations, measurements, mathematical verification and logical reasoning

direct evidence - close, logical sequence of things we see

indirect evidence - ideas, observations or statements arrived at by inferences or generalizations

inference - a statement that we think is true because of something we see

generalization - a statement we think to be true when we put together things we see or ideas that are true. A generalization may or may not be true.

Write direct or indirect for the evidence described in each paragraph.

1. A chemical has no color. When another chemical was mixed with it, it turned blue. Conclusion: The second chemical turned the first one blue.

   The change in color is _____ evidence.

2. When Mother got up in the morning, she saw crumbs on the kitchen floor. She had cleaned the floor before going to bed. Mother thinks, "Someone ate some food after I went to bed."

   The crumbs are _____ evidence.

3. When Jim leaves the room he turns off the lamp. When he comes back the lamp is on. Jim wonders who has turned on the lamp.

   The lighted lamp is _____ evidence that someone came into the room.

4. Water boils fast when Kathy turns the stove to high. Water does not boil as fast at medium or low. She measured the times. She found that on high the water boiled in 2 minutes, 34 seconds; on medium, 3 minutes, 12 seconds; and on low 4 minutes, 46 seconds.

   The times are _____ evidence that water boils faster on high than medium or low settings.

5. Nancy thinks blue is the most common color of shirt in her class. She counted what color shirt every student in her class was wearing. Her chart looked like this.

EVIDENCE - DIRECT AND INDIRECT cont.

Color of Shirts In Class 8A

| Color | Talley | Total |
|---|---|---|
| red, pink & maroon | ~~1111~~ | 5 |
| yellow or orange | 11 | 2 |
| blue | ~~1111~~ 1111 | 9 |
| green | 1 | 1 |
| white | ~~1111~~ ~~1111~~ 1 | 11 |
| gray or black | 111 | 3 |
| brown | 111 | 3 |
| multi,plaid or checkers | ~~1111~~ | 5 |

Nancy used this chart in her science fair project as _____ evidence to reject her hypothesis.

6. Hal notices that when he turns on his flashlight no light comes on. Hal thinks, "My batteries are burned out".

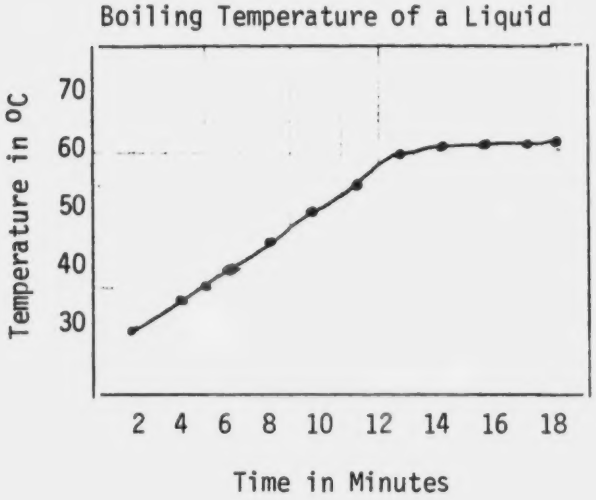
   The light not coming on is _____ evidence that the batteries are burned out.

7. The teacher said that the same magnetic poles push each other away. Opposite magnetic poles come together. Jackie put the two south poles of magnets near each other. When she let go they moved apart.

   Seeing the magnets moving is _____ evidence that the rule is correct.

8. Della was heating a liquid. She had a thermometer in it. She was writing the temperature of the liquid every two minutes. Then she made this graph.

EVIDENCE - DIRECT AND INDIRECT




In her report Della said that the boiling point of this liquid is $62^{o}C$. The graph can be used as _____ evidence to support Della's statement.

## EVIDENCE - DIRECT AND INDIRECT cont.

ANSWER KEY:

1. Direct
2. Indirect
3. Indirect
4. Direct
5. Direct
6. Indirect
7. Direct
8. Direct

 Name _____

## INFERRING

INFERENCE - an educated guess based on what you see.
OBSERVATION - what you can see

#1 After reading the paragraph below, identify the following statements as observations or inferences:

Pat received a present on the day before her birthday. The person who gave her the gift wrote on the box, "Not to be opened before your birthday." Pat, doesn't open the big box but shakes it, listens to it, and turns it over. Below are some statements Pat made. Which are observations? Which are inferences?

_____1. the box is heavy

_____2. there is something that sounds like it is rolling inside

_____3. because the box is big, the gift must be big

_____4. the box is warm

_____5. because it is big, the gift must be expensive

_____6. the gift is heavy

_____7. there is a ball inside the box

_____8. the box is green

 Name _____

## SIGNIFICANT AND INSIGNIFICANT

SIGNIFICANT - having some meaning to what happened

INSIGNIFICANT - having little or no meaning to what happened

Read the paragraph. Then mark S if the statement is significant or I if insignificant.

My eyes are blue and so are the frames of my glasses. I was reading the newspaper while sitting on the rug. I had taken off my glasses and laid them on the rug. When I went to bed I forgot my glasses. During the night my father came into the room and stepped on my glasses. My father yelled at me for being careless.

What happened: The glasses are broken.

1. _____ The color of the glasses.
2. _____ The glasses look good on me.
3. _____ My father's yelling.
4. _____ My reading the paper.
5. _____ My father stepping on the glasses.
6. _____ My leaving the glasses on the rug.

 Name _____

## REAL AND FANCIFUL

real - existing as a fact, true

fancy - imaginary, made up belief

The time is now, Here on earth.

Write Yes if the item is real
Write No if the item is fanciful

_____1. A snake 300 feet long

_____2. A striped fish

_____3. A plant that can eat a man

_____4. A bicycle you can ride to the moon

_____5. A boy or girl who can run 10 km. (6.2 miles) in one minute.

_____6. A machine that can make many copies of one paper

_____7. Dishes that can break

_____8. A machine that can do your homework with no help from you.

 Name _____

## CAUSE AND EFFECT

Remember:

cause - a thing that makes something happen

effect - something that happens because of a person, action or item's presence

Write cause or effect in each blank space.

A. During the night there was a storm. Many trees fell down. Some fell across roads. The next morning there was a big traffic problem.

The trees falling were the (1) _____ of the storm. The traffic problem was the (2) _____ of the trees falling. The wind was the (3) _____ of the trees falling and the trees falling was the (4)_____ of the traffic jam.

B. Teeth need calcium and phosphorus to stay strong and healthy. In some countries fish and chicken bones are chewed to get calcium and phosphorus. In other countries the shells of young shrimp are fried and eaten. In America the people get calcium and phosphorus from milk, cheese, and ice cream. When there is not calcium and phosphorus, teeth decay easily.

Shortage of calcium and phosphorus does not (5) _____ tooth decay but the (6) _____ of not enough calcium and phosphorus is faster tooth decay.

C. Father was riding the Metro. When the train was underground, it stopped and the lights went out. Many people were afraid. Five minutes later the lights came back on. The train began to move. The people were told that the electric power had failed. The repairmen had quickly fixed it.

 Name _____

CAUSE AND EFFECT cont.

The train stopping was a/an (7) _____ of the power failure. The lights going out were a/an (8) _____ of the power failure. The people being afraid was a/an (9)_____ of the train stopping and the lights going out. The lights coming back on and the train moving was a/an (10) _____ of the power being fixed. The power failure was the (11)_____ of the train stopping. The repairs were the (12) _____ of the train moving again.

ANSWER KEY REAL AND FANCIFUL

1. No
2. Yes
3. No
4. No
5. No
6. Yes
7. Yes
8. No

ANSWER KEY CAUSE AND EFFECT

C = cause E = effect

1. E
2. E
3. C
4. C
5. C
6. E
7. E
8. E
9. E
10. E
11. C
12. C

 Name _____

## IDENTIFYING PROBABLE HYPOTHESES

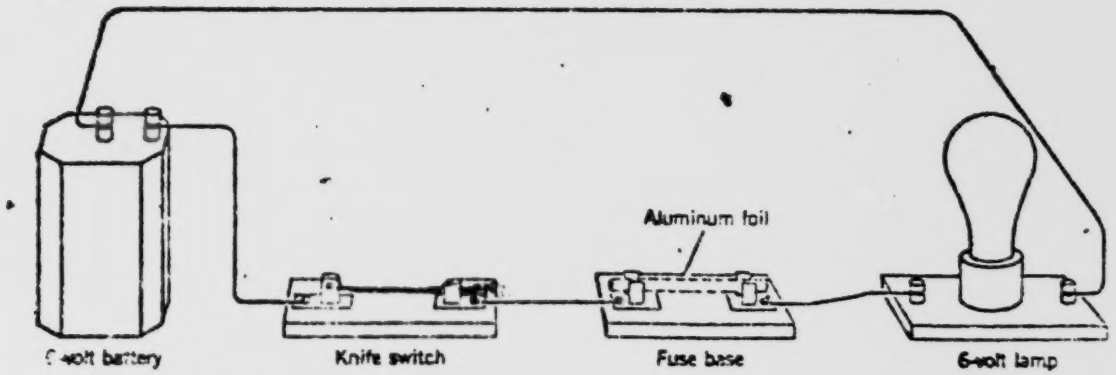
Remember:

hypothesis - an idea that you think is true that is not yet proven

probable - what you think is right because of what you see and what you already know

Write Yes for a probable hypothesis or No for a hypothesis that is not probable.

A. Tim and Ann put together an electrical circuit in the lab. The light bulb did not come on when the switch was closed.




_____1. The bulb is burned out.

_____2. Ann is a girl and circuits don't work for girls.

_____3. Tom is not good at math and this makes science things not work for him.

_____4. The dry cells are dead.

_____5. The bulb is not screwed in tightly enough.

_____6. A transmission wire is not touching a contact point.

_____7. The circuit is controlled by enemy agents.

IDENTIFYING PROBABLE HYPOTHESES cont.

B. Look at the picture at the bottom of the page.

_____1. The people are poor.

_____2. The people are both men.

_____3. The bottle contains vinegar.

_____4. The people are old.

_____5. It is the man's birthday.

C. Two liquid chemicals are mixed together. Bubbles are rising to the top. Some white solid material is going to the bottom of the beaker.

_____1. The bubbles are a gas formed from the two liquids.

_____2. The white solid material will dissolve the beaker.

_____3. Soon the beaker will explode.

_____4. The solid material came from the two liquids.

30

REPORT FORMAT

Hypothesis:

Equipment (What I Used)

Experiment: (What I Did)

Result: (What Happened)

Conclusion:

ANSWER KEY

# IDENTIFYING PROBABLE HYPOTHESES

A.
1. Yes
2. No
3. No
4. Yes
5. Yes
6. Yes
7. No

B.
1. No
2. No
3. No
4. Yes
5. No

C.
1. Yes
2. No
3. No
4. Yes

Name _____

# THE SCIENTIFIC METHOD

## Activity III - Writing an Hypothesis

Rewrite each problem as an hypothesis
(Remember: an hypothesis is what you think will happen. You can do a test to see if your idea is right or wrong.)

Example: Does Sound Travel Through Air?
Hypothesis: Affirmative: Sound travels through air.
Negative: Sound does not travel through air.

1. Does sound travel in water?

   Hypothesis: Affirmitive: _____

   or _____

   Negative: _____

   _____

2. Does sound travel in the dark?

   Hypothesis: _____

   _____

3. Does air make a sound?

   Hypothesis: _____

   _____

4. Do drums make sounds?

   Hypothesis: _____

   _____

5. Are sounds make by a whistle?

   Hypothesis: _____

   _____

 Name _____

## DRAWING CONCLUSIONS

conclusion - the final outcome, a decision or opinion reached by reasoning based upon measurable and repeatable data.

Read the four sentences. Then read the four conclusions. Only one of the four conclusions can be correct using only the information from the four statements. Choose the letter of the correct conclusion.

1. Mr Lynch bought a jacket.
   Two of his sons tried it on.
   It was too big for his son John.
   It was too little for his son Sam.

   A. Mr. Lynch only has two sons.
   B. John is younger than Sam.
   C. John is bigger than Sam.
   D. Sam is bigger than John.

2. Jim and Jack are twins.
   Jim gets better grades than Jack.
   Jim builds model planes.
   Jack likes to play basketball.

   A. Jim works harder than Jack
   B. Jack won't go to college.
   C. Jim and Jack are the same age.
   D. Jim wants to go to college.

3. Bill wants a hamburger and french fries.
   Together they cost $2.25.
   Bill does not have enough money for both.

   A. Fries cost $.60.
   B. A hamburger cost $1.65.
   C. Bill likes fries better than chicken.
   D. Bill has less than $2.25.

4. Platinum is more valuable than copper.
   Copper is a softer metal than platinum.
   Copper is used to make pennies.
   Platinum is used to make jewelry.

   A. Platinum and copper are both metals.
   B. Platinum and copper are both reddish-brown.
   C. Copper is more expensive than platinum.
   D. Copper is not used to make dimes.

5. The temperature of a liquid in a black container is 72°C.
   The temperature of a liquid in a silver container is 58°C.
   Water is the liquid in both containers.

   A. The sun was shining on the containers.
   B. Ammonia never has a temperature of 72°C.
   C. Water does not always have the same tenperature.
   D. The silver container is shiny.

6. Pauline and Mary have the same blouse.
   Pauline and Mary are friends.
   Pauline and Mary wear their identical blouses every Tuesday.
   Pauline is taller than Mary.

   A. The blouses were both green.
   B. Pauline and Mary go to the same school.
   C. Mary is only five feet three inches tall.
   D. Some days Pauline and Mary dress alike.

7. Sue and Carol make A's on their science reports.
   Sue is smarter than Carol.
   Sue and Carol are both on the basketball team.
   Carol has better handwriting than Sue.

   A. Carol sings better than Sue.
   B. Sue plays forward on the basketball team.
   C. Sue plays better basketball than Carol.
   D. Sue and Carol both take a science class.

9. Tony smells something
The smell is not good.
Tony sees something coming out of a bottle.
Tony sees a gray gas.

A. Tony can smell the gray gas.
B. The gas is smoke.
C. Tony does not like the smell.
D. Tony's father is smoking.

ANSWER KEY

DRAWING CONCLUSIONS

1. D
2. C
3. D
4. A
5. C
6. D
7. D
8. C

Name _____

# THE SCIENTIFIC METHOD

## Activity IV - Writing a Conclusion

Rewrite each hypothesis as a conclusion.
Use:
Yes, my hypothesis is true.
No, my hypothesis is false.

Example: Hypothesis: Sound travels through air.
Conclusion: Yes, my hypothesis is true. Sound travels through air.
or Hypothesis: Sound travels through air.
Conclusion: No, my hypothesis is false. Sound does not travel through air.

1. Hypothesis: Sound travels in water.

   Conclusion: _____

   _____

2. Hypothesis: Sound travels in the dark.

   Conclusion: _____

   _____

3. Hypothesis: Air does not make a sound.

   Conclusion: _____

   _____

4. Hypothesis: Drums make sounds.

   Conclusion: _____

   _____

5. Hypothesis: Sounds are made by a whistle.

   Conclusion: _____

   _____

Name _____

# THE SCIENTIFIC METHOD

## Activity V - Identifying the Steps of the Scientific Method

Write the steps of the Scientific Method in order.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Word List

| | | |
|---|---|---|
| Purpose | Title | Procedure |
| Conclusion | Results | Variable |
| Materials | Control | |
| Investigation | Hypothesis | |

Name _____

# THE SCIENTIFIC METHOD

Activity VI

When scientists ask a question, they think of a possible answer. This answer is called an hypothesis. Then they do an experiment and write down the results. If the hypothesis in not true (false), they may want to make a new hypothesis and test it. This way of solving a problem is called the Scientific Method.

Complete these sentences.

1. An hypothesis is _____

   _____

2. When you do an experiment, you write down _____

3. If the hypothesis is false, you may _____

   _____

4. A way of solving a problem is called the _____

   _____

Name _____

# COMPLETION - THE SCIENTIFIC METHOD

Activity VII

Complete with a correct word from the word list.

When scientists ask a _____, they think of a possible _____. This answer is called a _____. Then they do an _____ and write down the _____. If the hypothesis is not _____ (false), they may want to _____ a new hypothesis and _____ it. This way of _____ a problem is called the _____ Method.

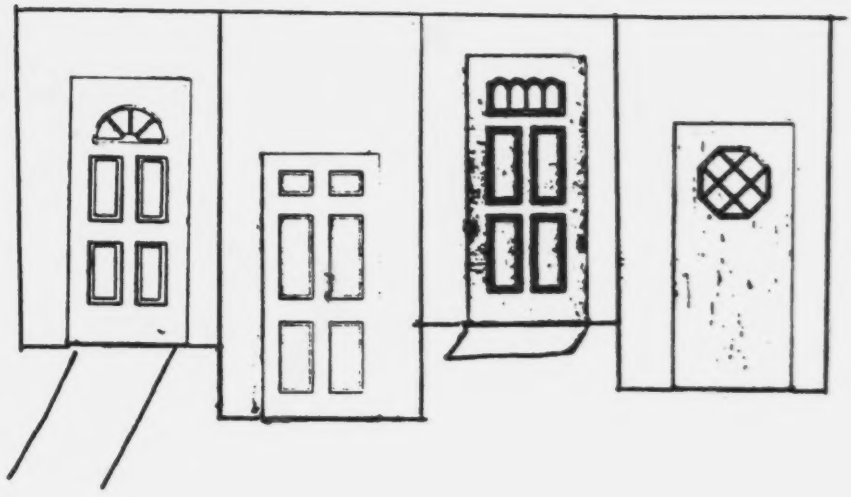
Word List:

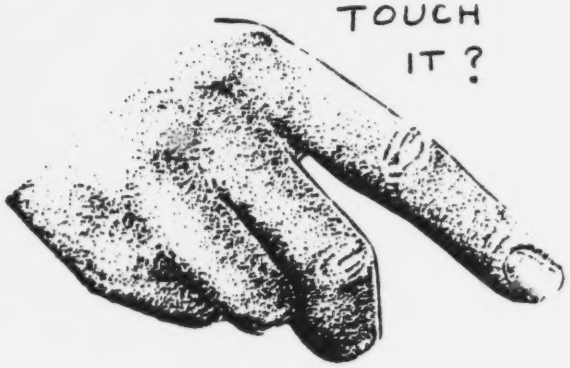
1. experiment
2. make
3. question
4. Scientific
5. true
6. solving
7. results
8. test
9. answer
10. hypothesis

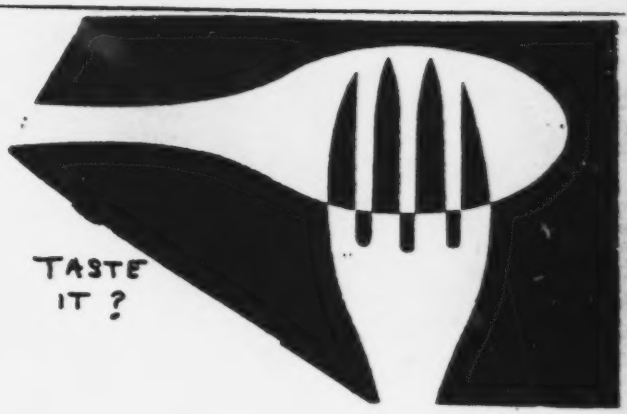
* For an additional activity, give the paragraph without the word list.

## DESCRIPTION OF OBSERVATIONS

We observe things with our senses to help us discover what something is.






CAN YOU ...

SMELL IT ?

DESCRIPTION OF OBSERVATIONS
REPORT

1. What does it feel like?
   (Some possibilities: soft or hard, warm or cold, wet or dry)

2. What does it taste like?
   (Some possibilities: sweet or sour, spicy, salty, flat)

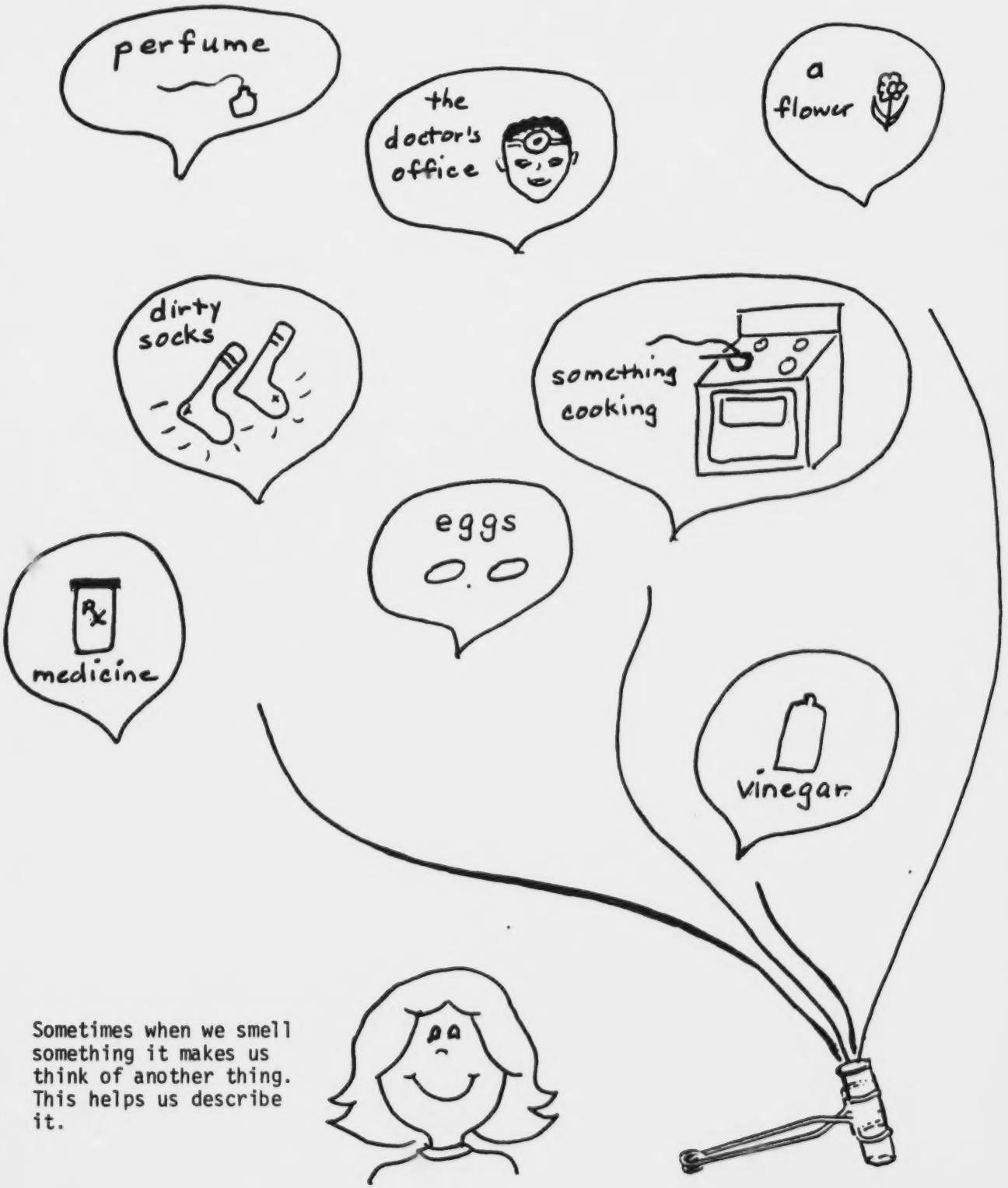
3. What does it look like?
   (Smoe possibilities: long or short, solid or liquid, big or little)

4. What does it smell like?
   (Some possibilities: rotten, sweet, spicy, sour)

5. What does it sound like?
   (Some possibilities: hiss, gurgle, bubbling, whistle, roar)

MIND PICTURES

That reminds me of . . .




Sometimes when we smell something it makes us think of another thing. This helps us describe it.

DESCRIPTION OF OBSERVATIONS

Mind Pictures

Sometimes when we smell something, it makes us think of something we know. Think about the smell of things, and what other thing it makes you remember. This might be a clue to what the unknown substance is.

Does it make you think of something you like to eat?

Does it make you think of something you <u>don't</u> like to eat?

Does it make you think of being outdoors?

Does it make you think of smells from a gas station?

Does it make you think of smells from a doctor's office?

Does it make you think of clean clothes, or soap?

Does it smell good?

Does it smell bad?

Does it smell like flowers?

Does it hurt your nose, or make your eyes water?

UNIT II

BASIC SKILLS

## BASIC SKILLS

In eighth grade physical science basic skills are taught specifically and then utilized throughout the year. Items in this section are designed to assist ESOL students with the language needed to operate in a laboratory situation. Those students who transferred into the classroom and missed the specific lessons on safety and names of laboratory equipment are often in need of reference materials to catch-up with the class. The materials in this section can assist the teacher in meeting these needs.

Basic Skills objectives from the curriculum guide included here are:

1. Identify physical science equipment and specify correct use.
2. Exhibit development of skills in experimental procedures.
3. Make volume, mass and linear measurement in metric units.
4. Interpret information as presented on data tables, diagrams, maps and graphs.
5. Use good safety procedures.
6. Evaluate pertinance of data.
7. Use mathematics and graphing to communicate data.
8. Apply common sense when making substitutes or facing emergency situations in the laboratory.

The materials on graphing included here are also designed to meet the following objectives.

9. Design adequate plans for the collection and recording of data, including appropriate measuring devices, necessary equipment, data tables and process sequencing.
10. Interpret data to identify a pattern, extend a trend beyond the given data, and check the consistency of an hypothesis.

1] Widemouthed Bottle
2] Erlenmeyer Flask
3] Florence Flask
4] Filter Flask
5] Beaker
6] Evaporating Dish

7] Bunsen Burner
8] Wing Top
9] Tripod
10] Wire Triangle
11] Wire Gauze with asbestos center

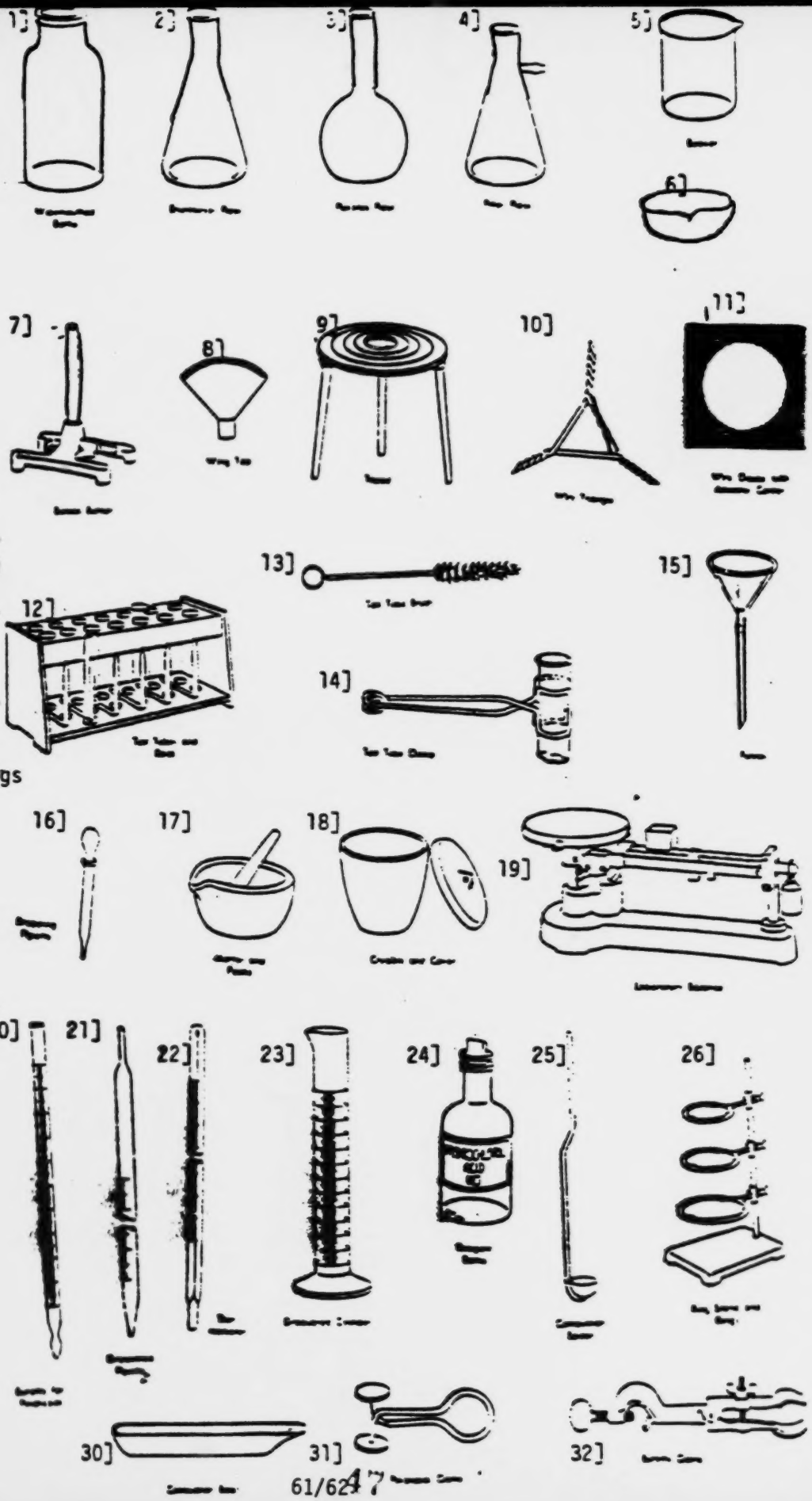
12] Test tubes and rack
13] Test Tube Brush
14] Test tube clamp
15] Funnel

16] Dropping Pipette
17] Mortar and Pestle
18] Crucible and Cover
19] Laboratory Balance

20] Burette for Pinchcock
21] Graduated Pipette
22] Thermometer
23] Graduated Cylinder
24] Reagent Bottle
25] Combustion Spoon
26] Ring Stand and Rings

27] Forceps
28] Tongs
29] Steel Spatula

30] Combustion Boat
31] Pinchcock Clamp
32] Clamp



Thermometer

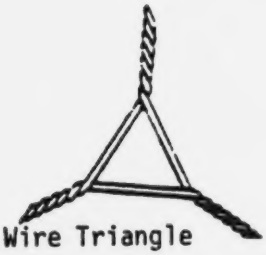
Tongs

Beaker

Mortar & Pestle

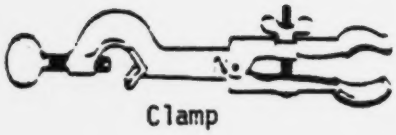
Reagent Bottle

Flask

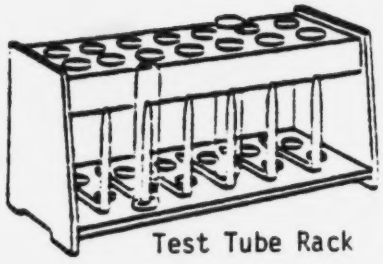


Wire Triangle

Wire Gauze with Asbestos Center



Clamp



Test Tube Rack

Write the name of the equipment that will finish each sentence:

1. The tool to pick up a hot beaker with is called _____.

2. A wide-topped glass container that can hold solids or liquids or mixtures and can be used to heat them is called a _____.

3. A glass container that can be closed with a stopper is called a _____.

4. The place to put a test tube when you are not holding it is the _____.

5. A tool to measure temperature with is called a _____.

6. The piece of equipment that can be fastened on the stand to hold a test tube over the Bunsen burner is called a _____.

7. The type of bottle with a glass stopper that is used to store all chemicals is called a _____.

8. The equipment used to grind dry chemicals into a powder is called a _____.

9. To hold the beaker on the ring when you heat the beaker, you can use the _____ or the _____ .

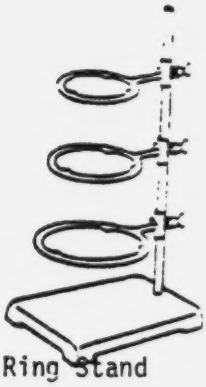
Graduated Cylinder

Funnel

Dropping Pipette

(Dropper)

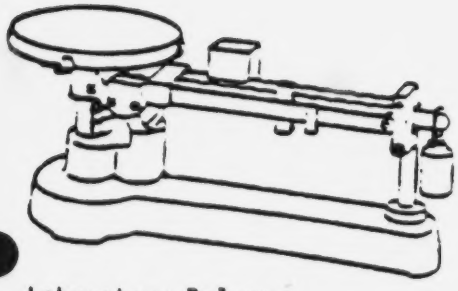
Tripod



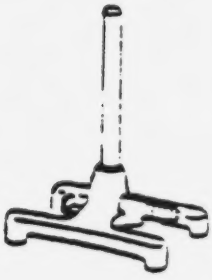
Ring Stand

Test Tube Clamp

Test Tube



Laboratory Balance



Bunsen Burner

Test Tube Brush

Write the name of the equipment that will finish each sentence:

1. A small glass container to make combinations of chemicals in is called a _____.
2. A small gas tube that the fire comes out of is called _____.
3. A piece of equipment to pick up a test tube with is called a _____.
4. A glass container to <u>measure</u> liquids is called a _____.
5. Something to clean a test tube with is called a _____.
6. A stand with three legs is called a _____.
7. Something to weigh solids is called a _____.
8. Something to measure a liquid drop by drop is called a _____.
9. A stand to hold clamps for holding containers over the burner is a _____.
10. A piece of equipment used to pour liquid carefully from one container to another container is called a _____.

LAB SAFETY

1. Always pick up hot things with a hot pad or beaker tongs. Never touch something hot with your hands.

2. Use a bulb to transfer liquids. Never use your mouth to suction a liquid out of a container.

3. Clean everything when you are finished. Never leave chemicals or dirty equipment out on the lab table.

4. Tell the teacher if you break something or spill something. Use a broom or mop to clean up spills. Never try to clean up an accident with just your hands; you could get cut or burned.

5. Sit up straight in your chair, with all four legs of the chair touching the floor. Do not tip back in your chair.

6. If you have long hair, keep it tied back. Be careful to keep hair away from fire or chemicals.

7. Slide a glass tube slowly and carefully through a stopper. Never push it hard or grab it.

8. Always keep your attention on the experiment you are doing. Do not turn away or talk to others, especially when you are pouring chemicals.

9. If you get cut or burned, go to the teacher immediately for help. You must tell the teacher about any injury, no matter how small it seems.

10. Always wear goggles to protect you eyes when you are working in the lab.

11. Always wear a laboratory apron to protect your clothes and your body from burns or spills.

LAB SAFETY QUIZ

Match the vocabulary to the correct sentence. Put the letter of the vocabulary word on the line in front of the sentence.

Vocabulary

a. hot pad or tongs
b. bulb
c. clean
d. mop or broom
e. tied back
f. floor
g. slowly and carefully
h. on your experiment
i. help
j. goggles
k. apron

Sentences

_____ 1. You wear this to protect your clothes and body.

_____ 2. You use this to pick up something hot.

_____ 3. Keep long hair this way.

_____ 4. Keep all four legs of your chair touching this.

_____ 5. You wear this to protect your eyes.

_____ 6. If you get hurt, you ask the teacher to do this.

_____ 7. You use this to transfer liquids from one container to another.

_____ 8. This is how you push a glass tube through a stopper.

_____ 9. This is how you leave everything when you are finished.

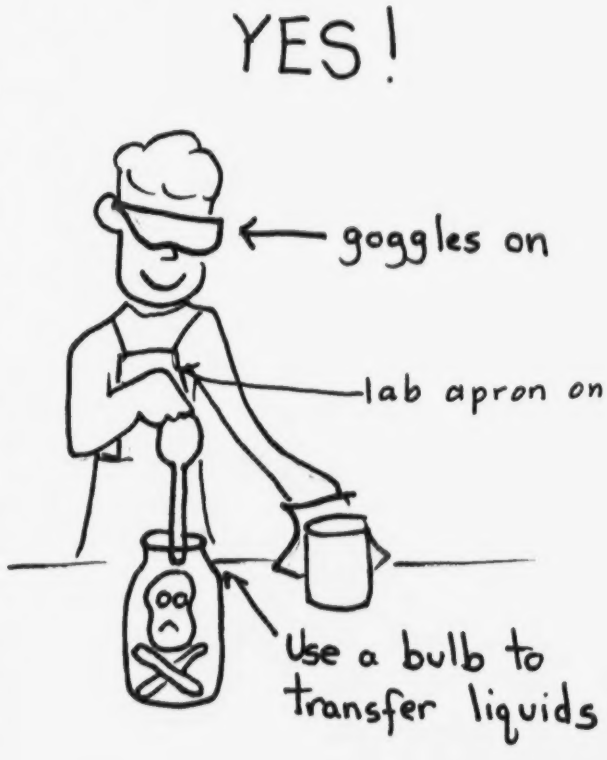
_____10. You must always keep your attention here when you are working in the lab.

_____11. When you drop something on the floor, you clean it up with this.

NO!

YES!
goggles on
lab apron on
Use a hot pad
or beaker tongs

NO!


YES!
goggles on
lab apron on
Use a bulb to
transfer liquids

NO !

YES !

lab apron on

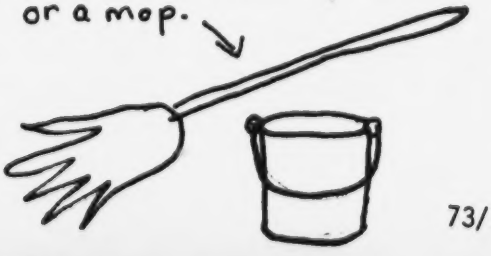
clean everything
when you are finished

Did you spill something?
Did you break something?

Do not touch it with your hands!

Tell the teacher you need help.

Ask the teacher for a broom or a mop.



NO!

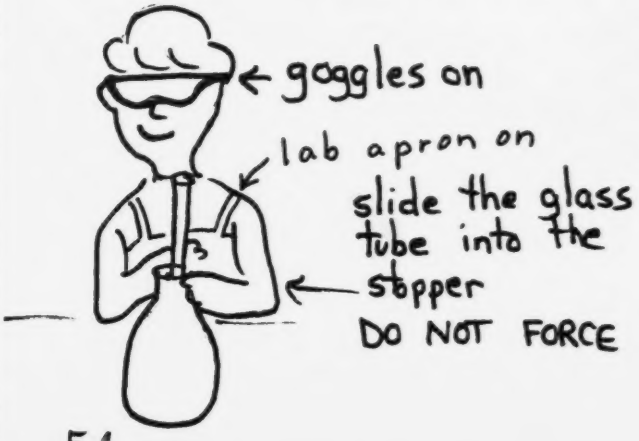
YES!

NO!

YES!

NO!

YES!



NO!

YES!

watch what you are pouring.

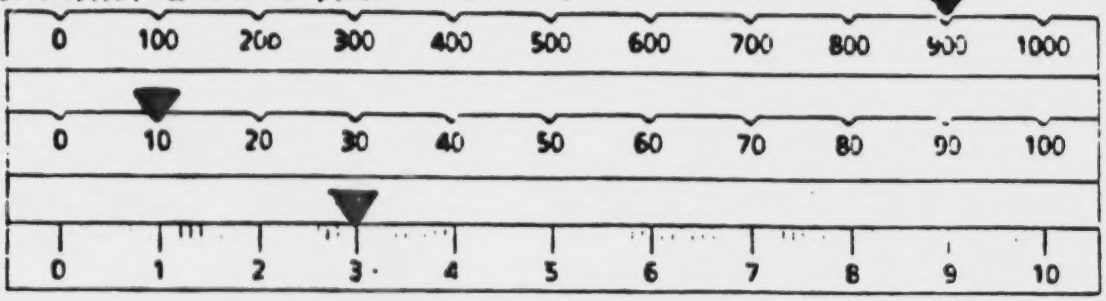
NO!

YES!

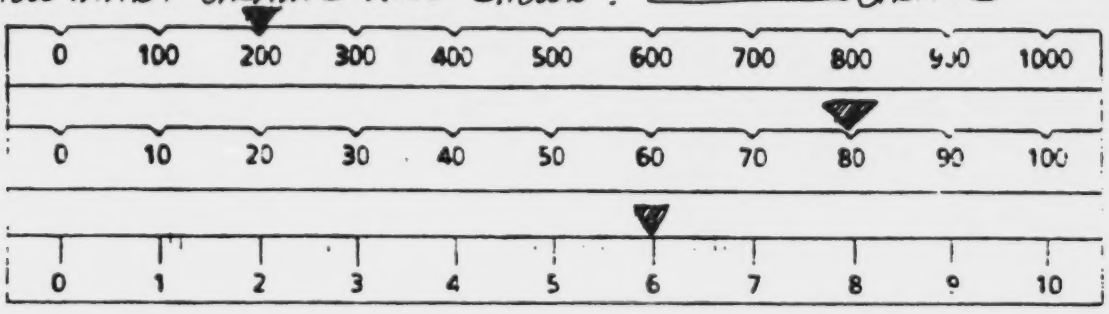
Get help from the teacher if you are hurt.

MEASUREMENT ACTIVITY

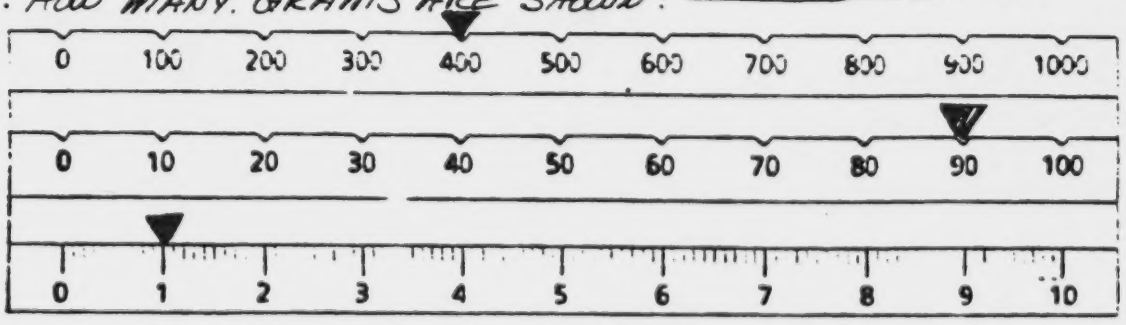
A. HOW MANY GRAMS ARE SHOWN? _____ GRAMS



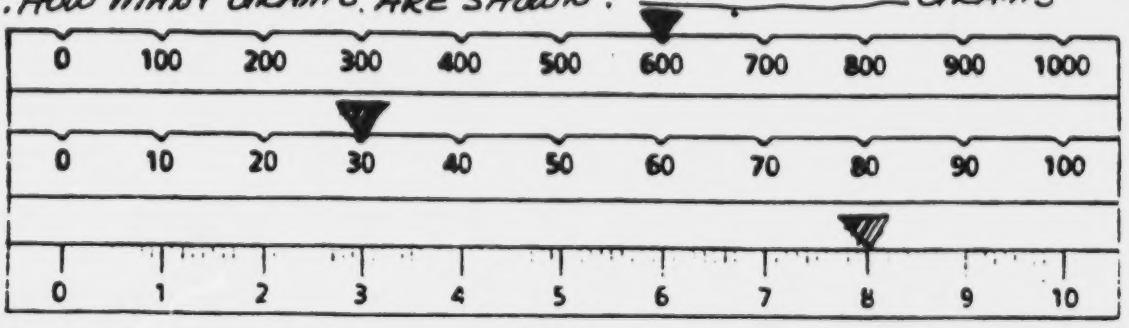

B. HOW MANY GRAMS ARE SHOWN? _____ GRAMS




C. HOW MANY. GRAMS ARE SHOWN? _____ GRAMS.



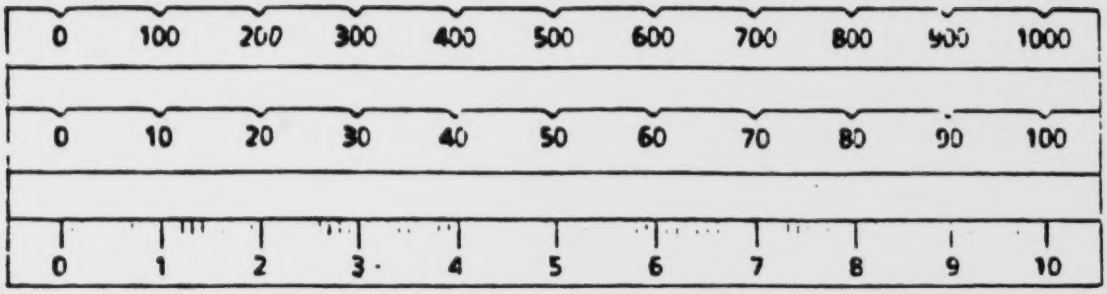

D. HOW MANY GRAMS. ARE SHOWN? _____ GRAMS



MEASUREMENT ACTIVITY

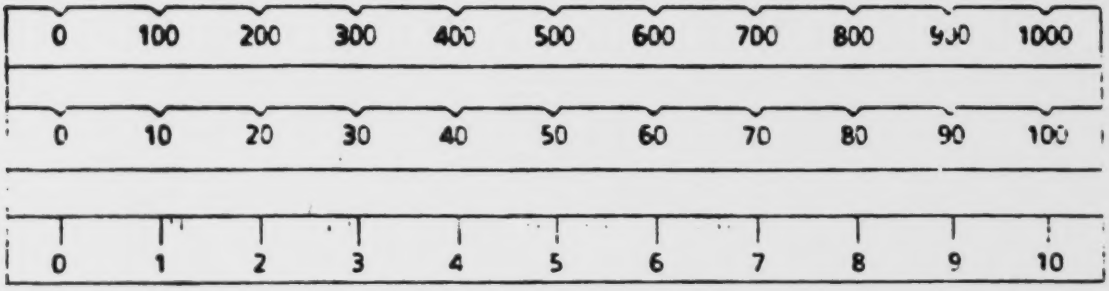
A. MARK 384 GRAMS ON THE FOLLOWING SCALE.

A.



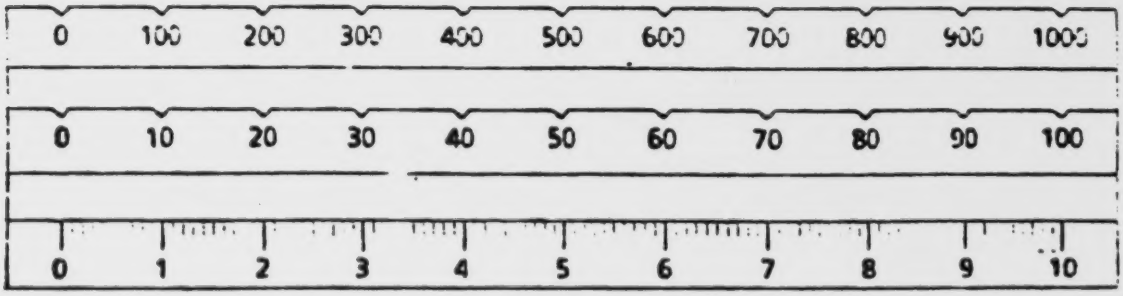

B. MARK 179 GRAMS

B.



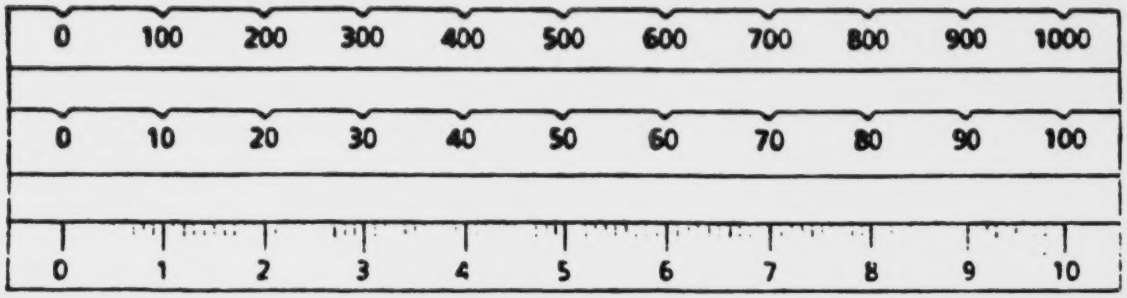

C. MARK 917 GRAMS

C.




D. MARK 1005 GRAMS

D.



# MASS

**mass** - the amount of matter, measured by a balance

Circle the correct measurement for the picture.

4. medicine in a spoon

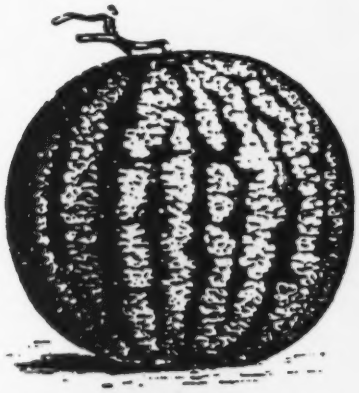
ag 50g 500g

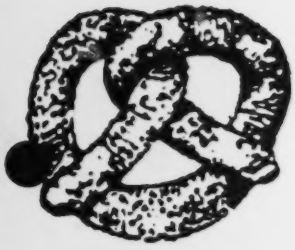
1. turkey

1kg 10kg 100kg

5. watermelon

. .8g 8g 80g



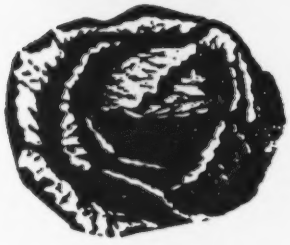


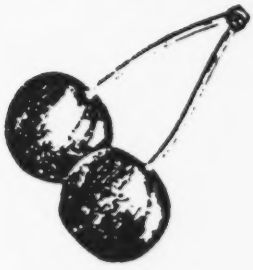
2. pretzel

10g 100g 1000g

6. cabbage

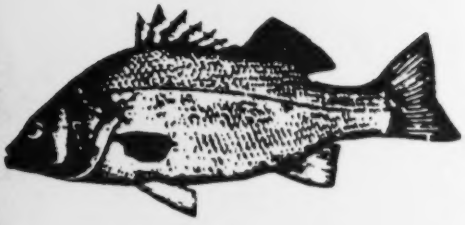
.1kg 1kg 10kg





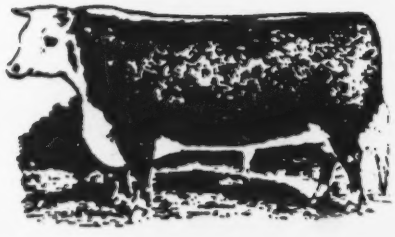
7. 2 cherries

5g 50g 500g



3. medium fish

15g 150g 1500g



8. cow

4kg 40kg 400kg

| | |
|---|---|
| kilogram (kg) | 1000 grams |
| hectogram (hg) | 100 grams |
| dekagram(dag) | 10 grams |
| gram (g) | 1 gram |
| decigram (dg) | 0.1 grams |
| centigram (cg) | 0.01 grams |
| milligram (mg) | 0.001 grams |

Convert using a decimal point.

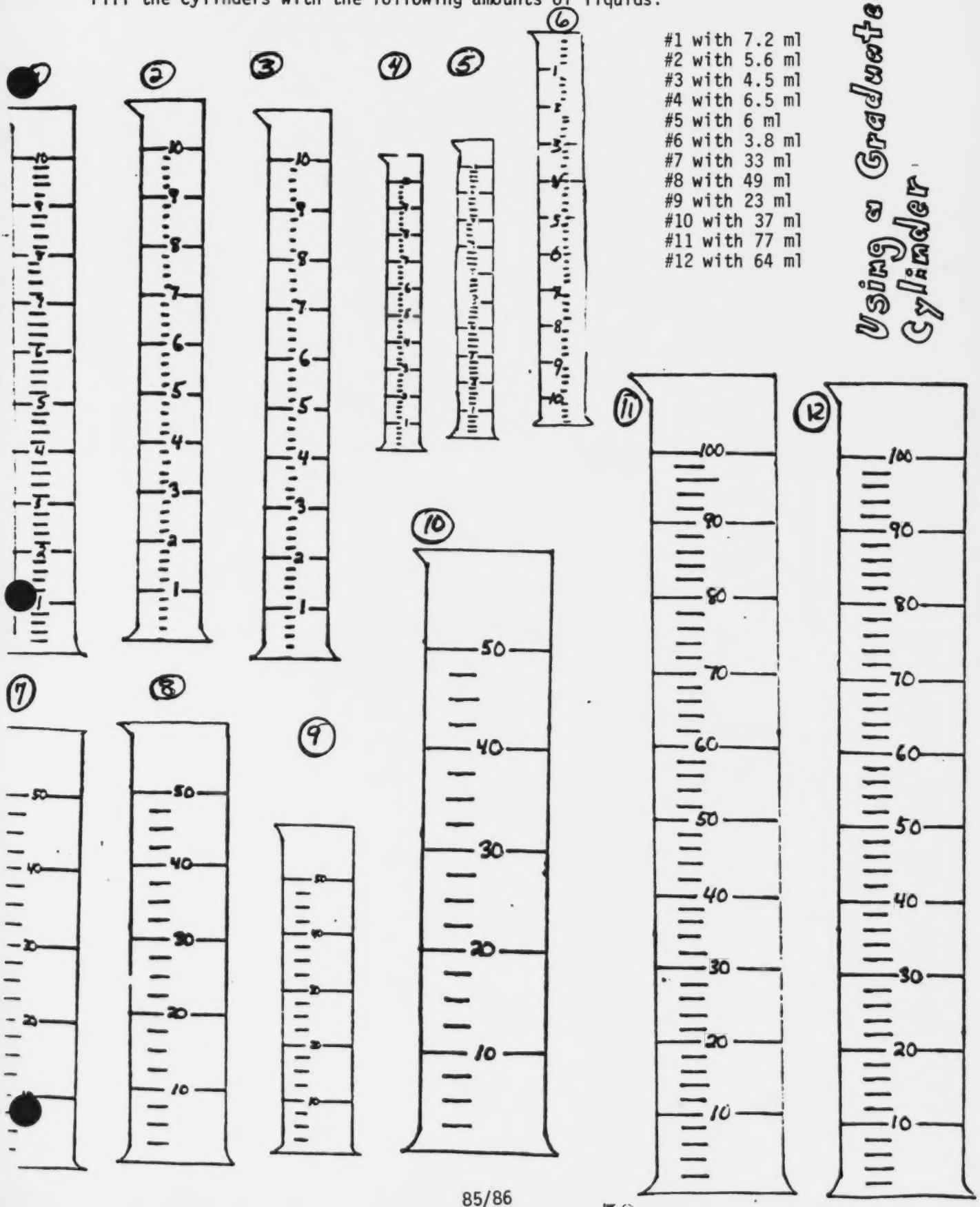
9. 5 g = _____ kg
10. 10 mg = _____ g
11. 18 kg = _____ g
12. 25 g = _____ kg
13. 100 kg= _____ g
14. 2 g = _____ kg
15. 15 kg = _____ g

83/84

# Using a Graduated Cylinder

Fill the cylinders with the following amounts of liquids:

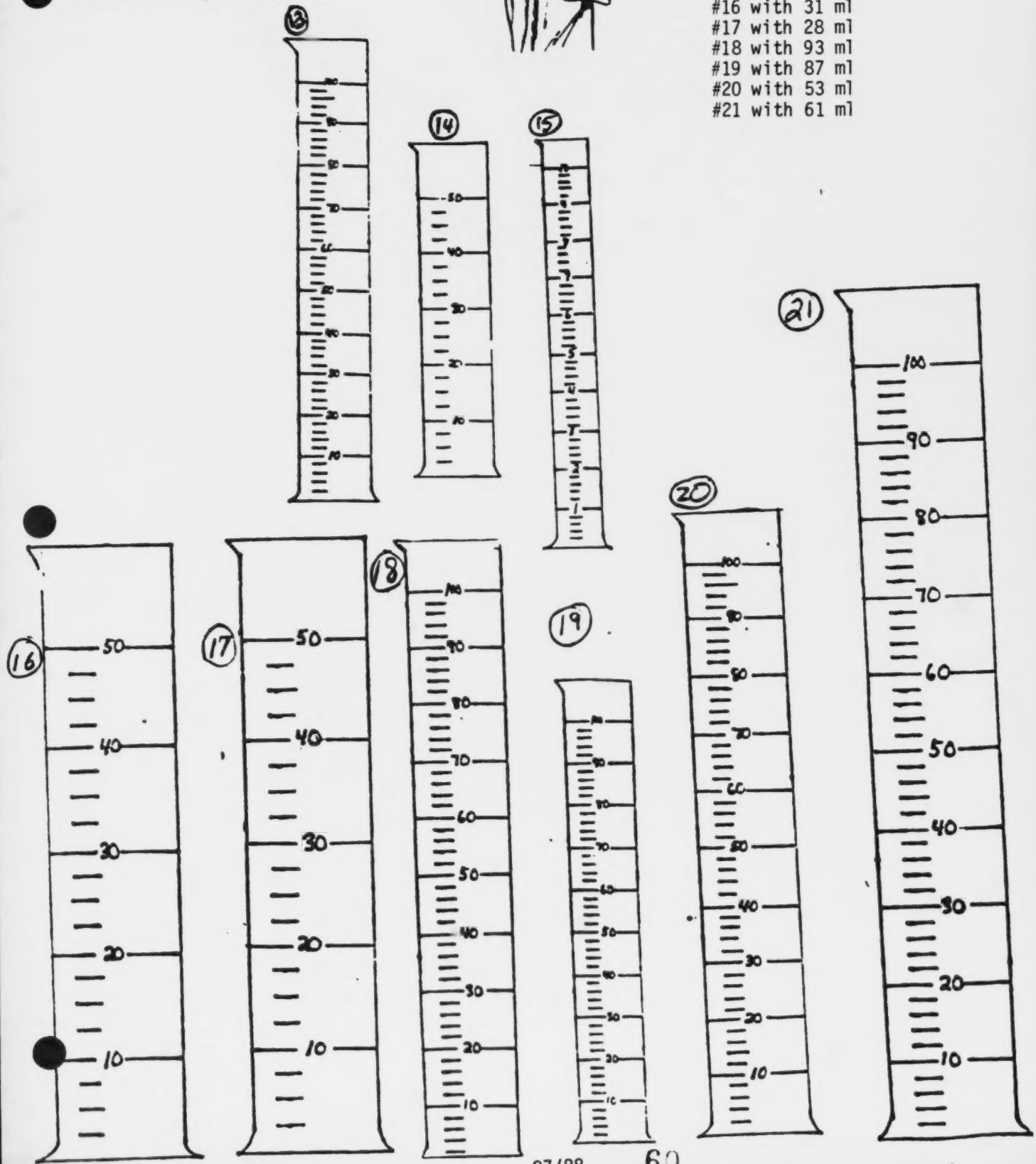
#1 with 7.2 ml
#2 with 5.6 ml
#3 with 4.5 ml
#4 with 6.5 ml
#5 with 6 ml
#6 with 3.8 ml
#7 with 33 ml
#8 with 49 ml
#9 with 23 ml
#10 with 37 ml
#11 with 77 ml
#12 with 64 ml



Indicate which cylinder would be best to measure the following amounts
*use 10 ml, 50 ml, or 100 ml for your answers.

Fill:

#13 with 85 ml
#14 with 18 ml
#15 with 9.4 ml
#16 with 31 ml
#17 with 28 ml
#18 with 93 ml
#19 with 87 ml
#20 with 53 ml
#21 with 61 ml



# GRAPHING

Graphing is one of the most direct ways to record information for purposes of contrast and comparison. This is a precise skill which many ESOL students may not have had experience in using. Therefore, a considerable amount of space is given to illustrating various kinds of graphs. It is also suggested that instruction in graphing can be enriched with the use of teaching materials from the math department.

Name_____ Date _____

These two pages on the standard liquid measurement system in common use in the United States are intended for information purposes only. The ESOL student is usually not familiar with them and should be helped to understand the correlation of different units.

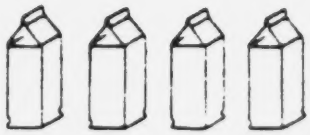
# Measuring Liquids

These are standard units for measuring liquids:

8 fluid ounces = 1 cup

2 cups = 1 pint

2 pints = 1 quart

 4 quarts = 1 gallon

1. ...8... ounces = 1 cup.
2. ...16... ounces = 2 cups.
3. ...2... cups = 1 pint.
4. ...4... cups = 2 pints.
5. ...2... pints = 1 quart.
6. ...4... quarts = 1 gallon.
7. ...8... pints = 1 gallon.
8. ...1... cups = $\frac{1}{2}$ pint.
9. ...2... quarts = $\frac{1}{2}$ gallon.
10. ...8... quarts = 2 gallons.

You know the size of a quart milk carton. Compare each of the following with 1 quart by using one of the symbols >, =, <.

> "is greater than"
> = "equals"
> < "is less than"

11. 1-gallon can of gasoline ...>... 1 quart.
12. 16-ounce bottle of salad oil ...=... 1 quart
13. $\frac{1}{2}$-gallon jug of cider ...>... 1 quart
14. 14-ounce bottle of hand lotion ...<... 1 quart
15. 48-ounce can of tomato juice ...>... 1 quart
16. 32-ounce bottle of detergent ...=... 1 quart

. Each picture represents a gallon jug. Shade each jug to indicate how full it would be.

SAMPLE.

4 quarts

17.

3 quarts

18.

2 quarts

19.

1 quart

20.

2 pints

21.

1 pint

22.

½ gallon

23. The metric system unit for measuring liquids is the liter. A liter is just a little larger than 1 quart. If your car holds 20 gallons of gasoline, will 20 liters fill it? _____

24. A recipe for punch is given below. The eighth grade is going to have a party. They will need four times this amount of punch. Find how much of each item will be needed.

| Recipe for Punch Serving 50 | Four Times the Recipe Serves 200 |
|---|---|
| 1 cup lemon juice | _____ quart lemon juice |
| 2 cups orange juice | _____ quarts orange juice |
| 1 cup tea | _____ quart tea |
| 2 cups pineapple juice | _____ quarts pineapple juice |
| 2 cups fruit syrup | _____ quarts fruit syrup |
| 1 quart soda water | _____ gallon soda water |
| 1 gallon ice water | _____ gallons ice water |

# CAPACITY

capacity - the amount an object can hold.

Circle the correct measurement for the picture.

1. tea kettle

3 ml  3l  3kl

2. barrel

4ml  4l  4kl

3. teaspoon

10ml  10l  10kl

4. box of tea

1ml  1l  1kl

5. laddle

200ml  200l  200kl

6. water glass

300ml  300l  300kl

7. fish bucket

20ml  20l  20 kl

8. jar for mustard

500ml  500l  500kl

| | |
|---|---|
| 1 kiloliter (kl) | 1000 liters |
| 1 hectoliter (hl) | 100 liters |
| 1 dekaliter(dal) | 10 liters |
| 1 liter (l) | 1 liter |
| 1 deciliter (dl) | 0 1 liters |
| 1 centiliter (cl) | 0 01 liters |
| 1 milliliter (ml) | 0 001 liters |

Convert by using a decimal point.

9. 1 ml = _____ l
10. 1 ml = _____ kl
11. 21 l = _____ ml
12. 5 kl = _____ l
13. 8 kl = _____ kl
14. 500 ml = _____ l
15. 2000 ml = _____ kl
16. 241 = _____ ml
17. 8501 = _____ kl
18. 55 ml = _____ l
19. 171 = _____ ml
20. 2751 = _____ kl



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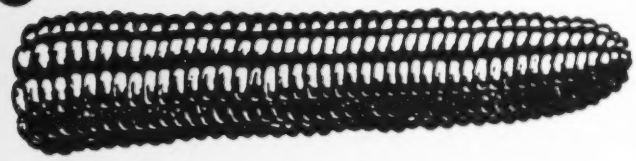
# METER

meter - metric unit for length, width and height

Circle the correct measurement for the length of these items.

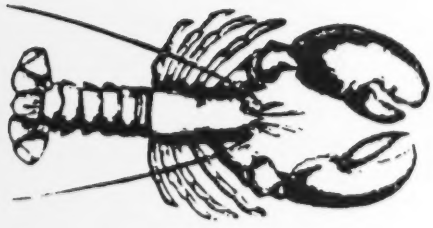


1. ear of corn

30mm 30cm 30m

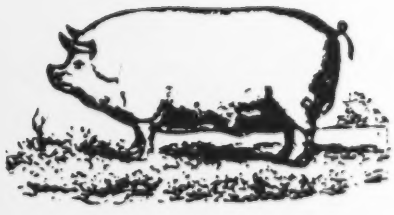
2. pea pod

40mm 40cm 40m



3. lobster

57mm 57cm 57m



4. pig

1mm 1cm 1m

5. spider

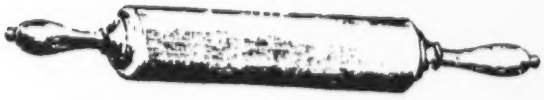
12mm 12cm 12m

6. chair

1nn 1cm 1m

7. small fish

20mm 20cm 20m



8. rolling pin

43mm 43cm 43m

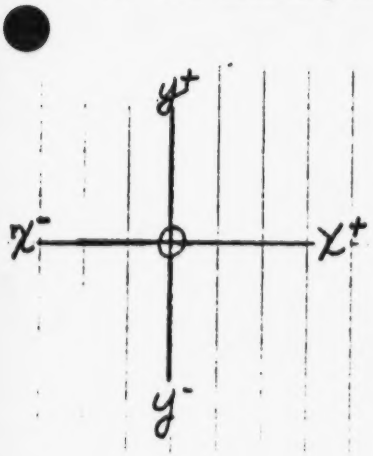
| | |
|---|---|
| kilometer (km) | 1000 meters |
| hectometers (hm) | 100 meters |
| dekameter(dam) | 10 meters |
| meter (m) | 1 meter |
| decimeter (dm) | 0.1 meters |
| centimeter (cm) | 0.01 meters |
| millimeter (mm) | 0.001 meters |

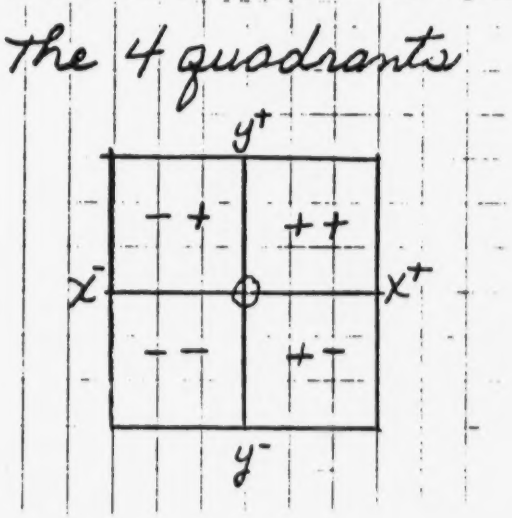
Convert using a decimal point.

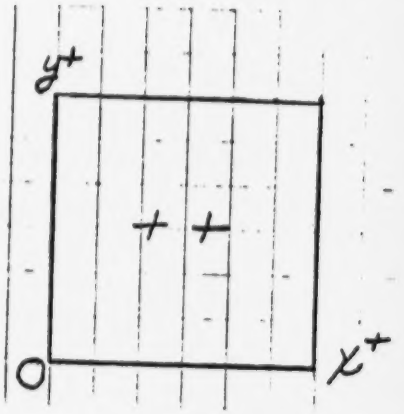
9. 75 cm = _____ m
10. 3 mm = _____ cm
11. 65 cm = _____ m
12. 400 m = _____ mm
13. 12 mm = _____ cm
14. 67 cm = _____ m
15. 400 m = _____ cm

NUMBERING LINE GRAPHS

1. The crossing of the Y axis and the X axis is the 0 point.

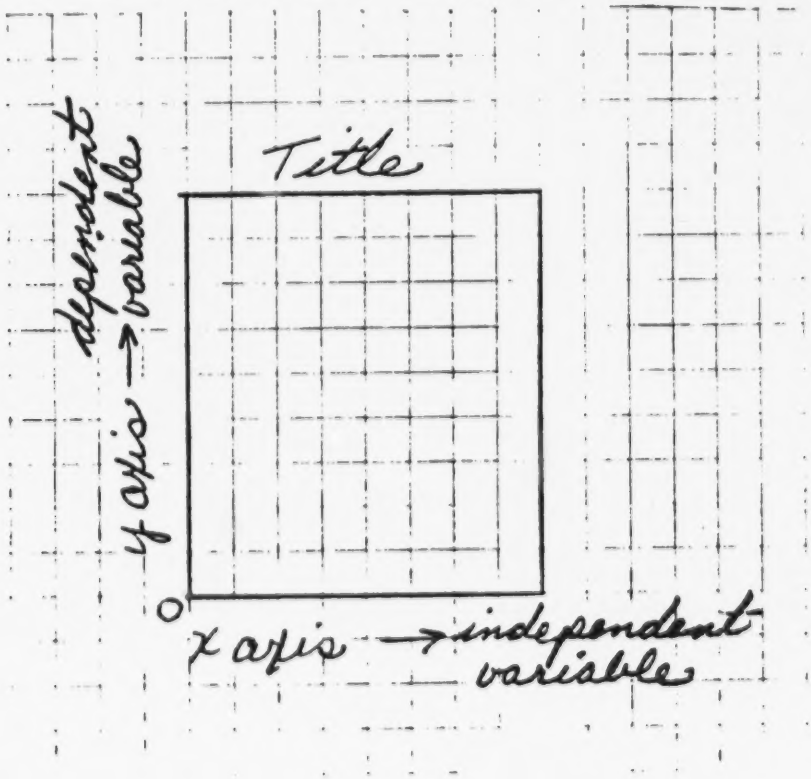


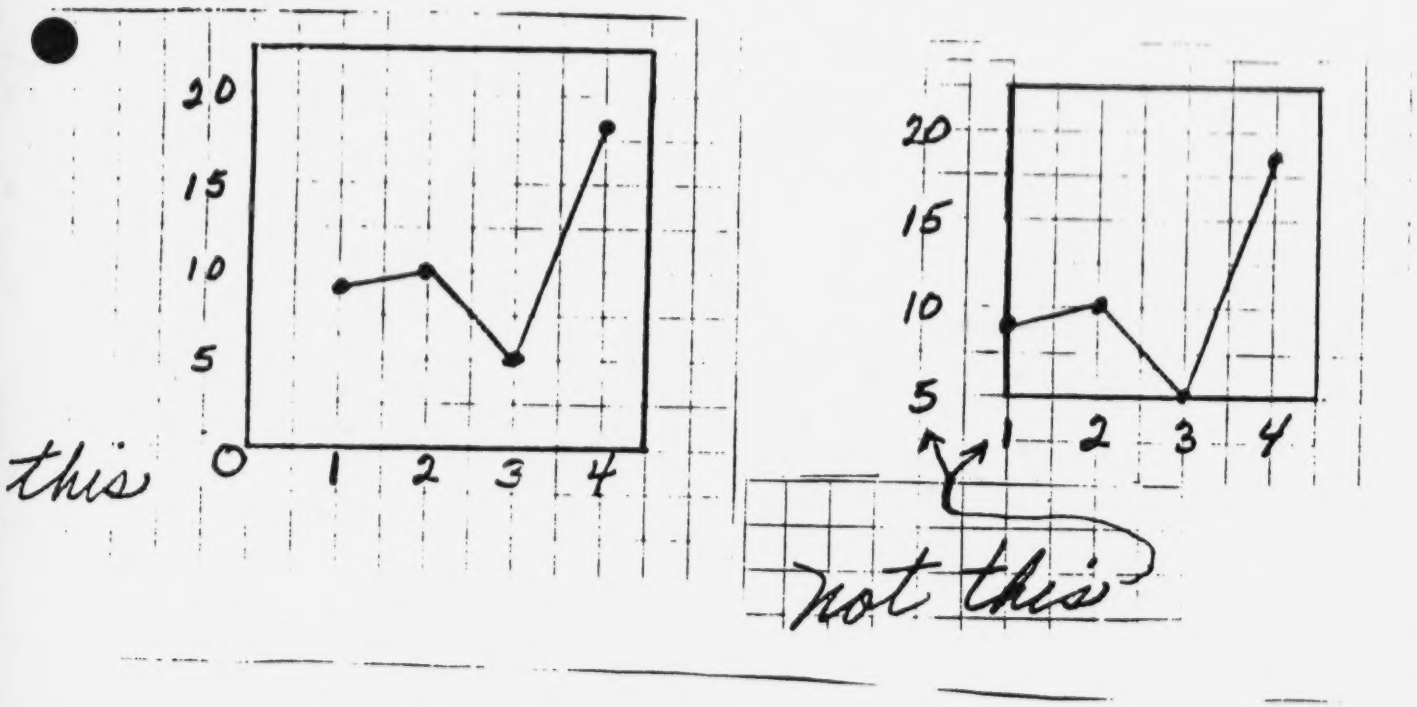




Often only the ++ quadrant is used..

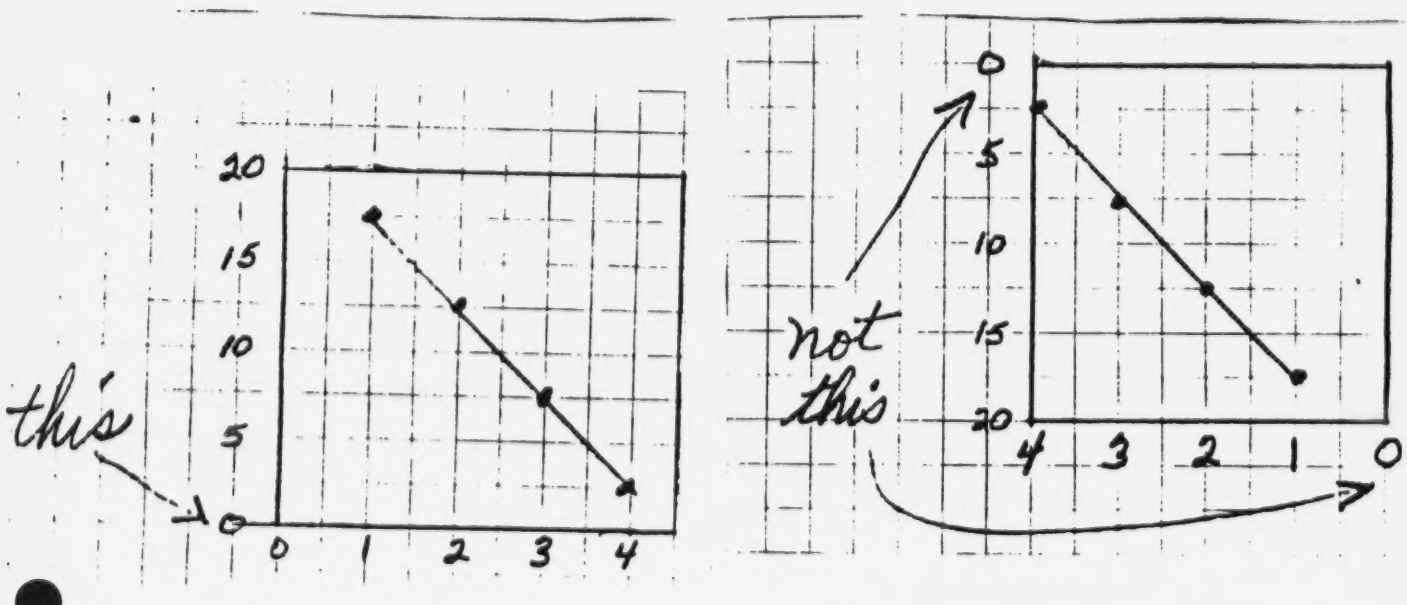
2. The numbers for the independent variable are placed along the bottom.
The numbers for the dependent variable are placed along the left side.



3. Numbering starts at 0 in the bottom left corner.




4. Numbers are smallest on the left to largest on the right.

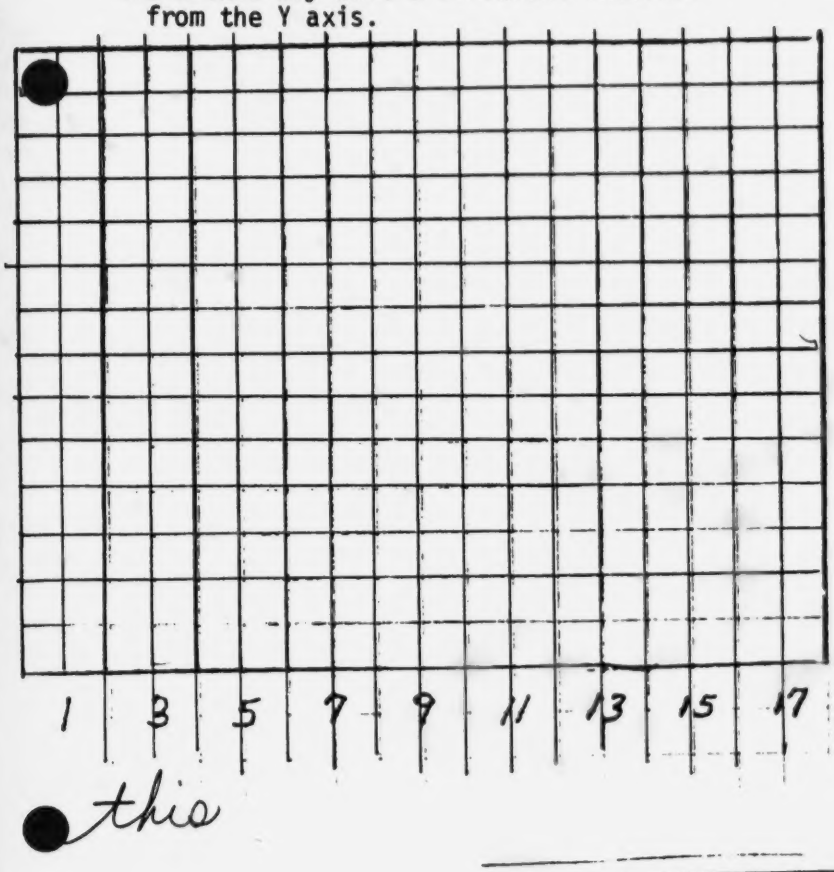


5. Units must be of equal intervals. Examples:

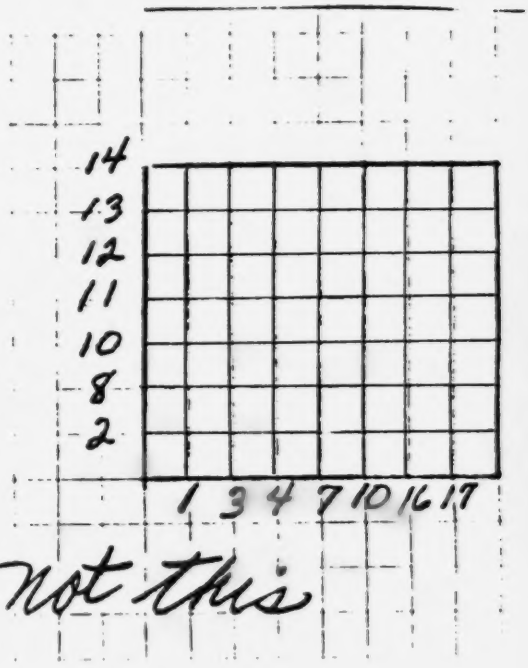
| | | | | |
|---|---|---|---|---|
| 0 | .2 | .4 | .6 | .8 |
| 0 | 1 | 2 | 3 | 4 |
| 0 | 5 | 10 | 15 | 20 |

You must choose the interval that is suitable for the data.

The X axis may have a different interval from the Y axis.

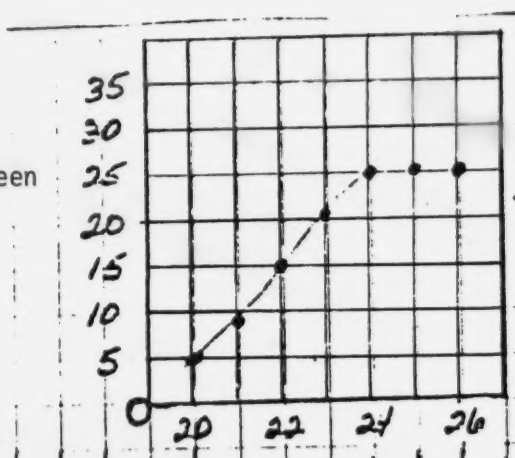



this



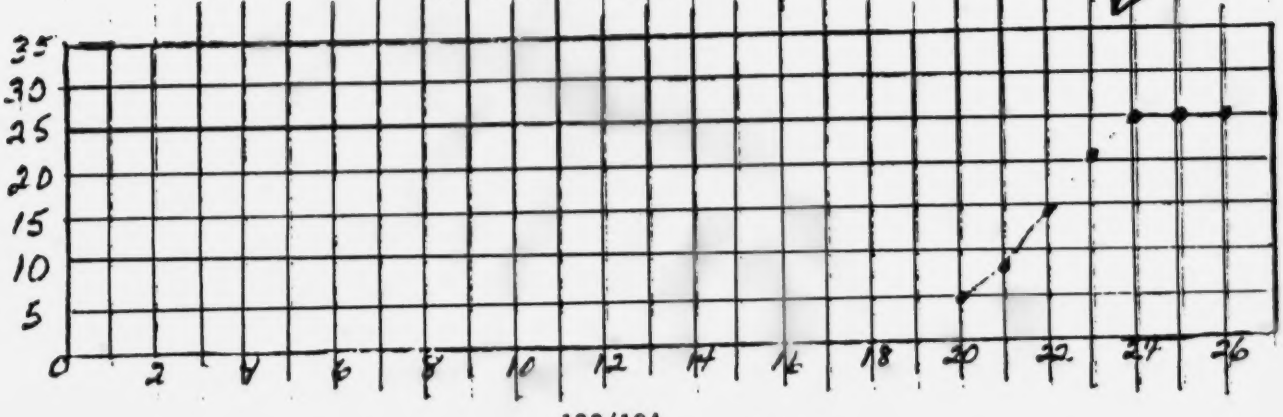

not this

6. If there is no data between 0 and a large number you may begin numbering from the large numbers.

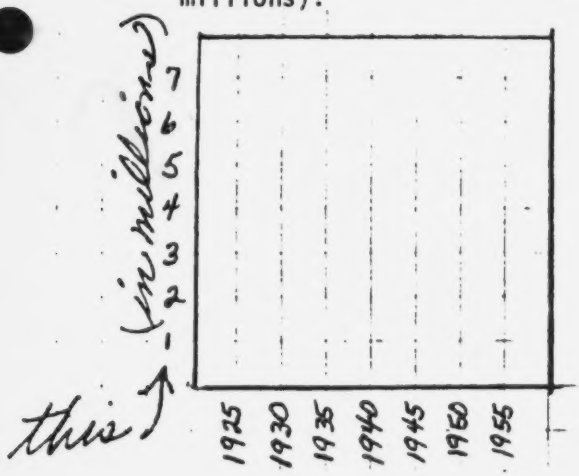


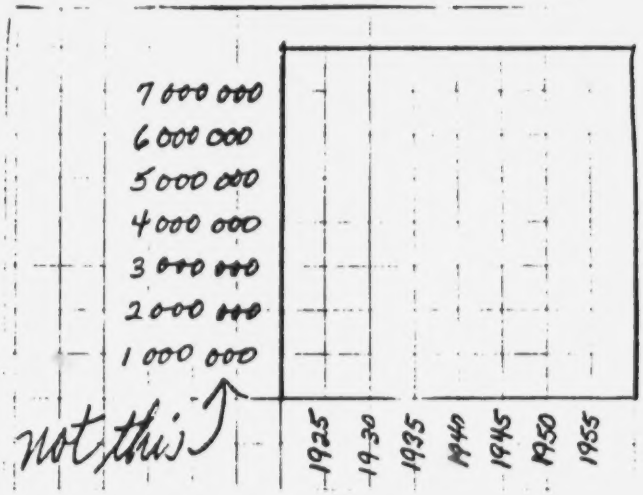

this

not this

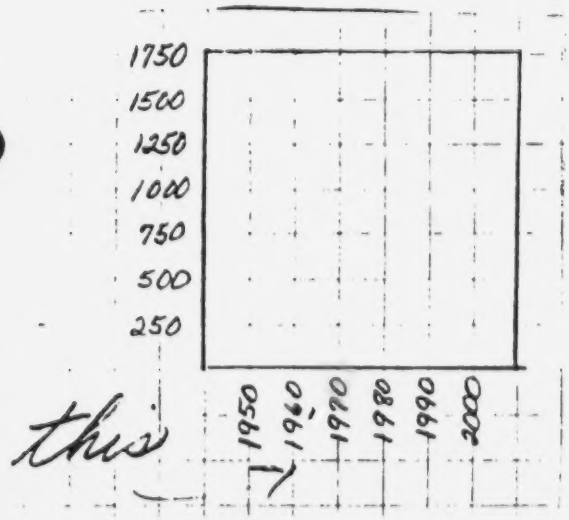


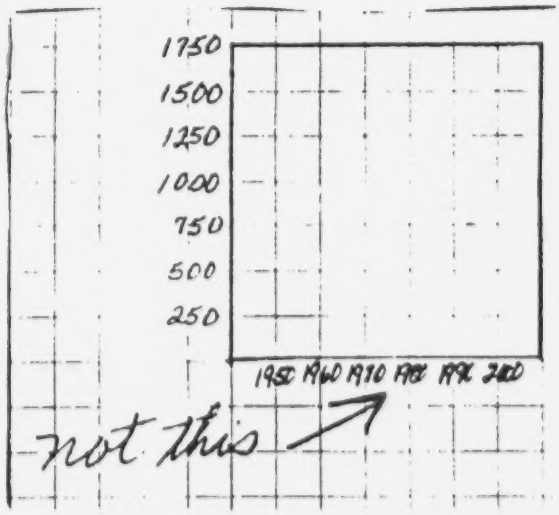
7. For large numbers, put the basic unit in words (such as hundreds, thousands, millions).



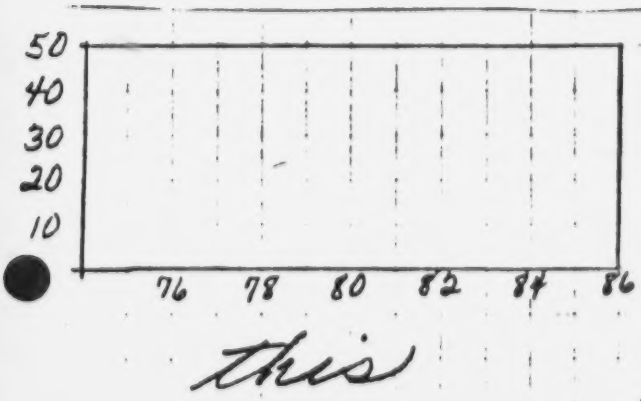



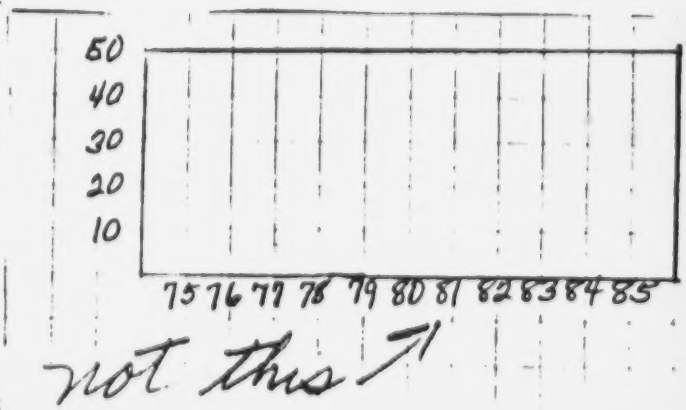

8. If dates or other numbers become crowded you may turn them sideways or number every other line.



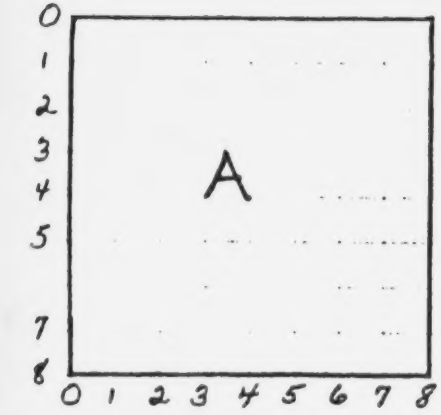



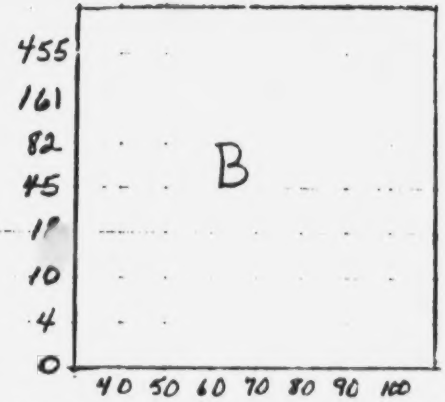

and

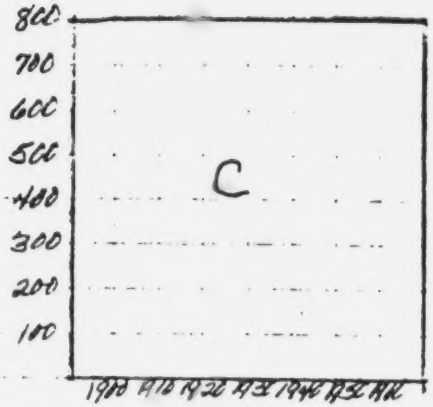


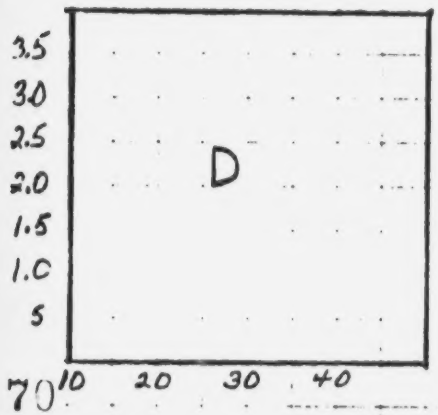



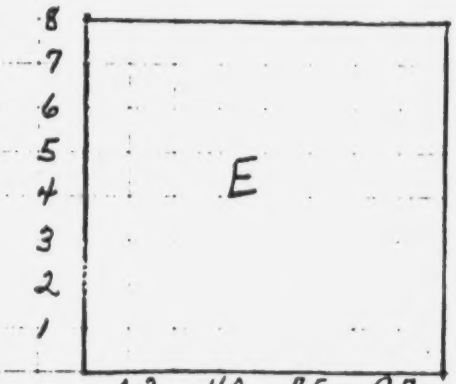
What's Wrong With the Numbering?

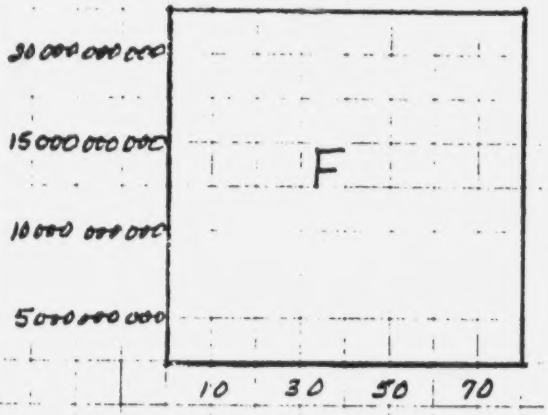


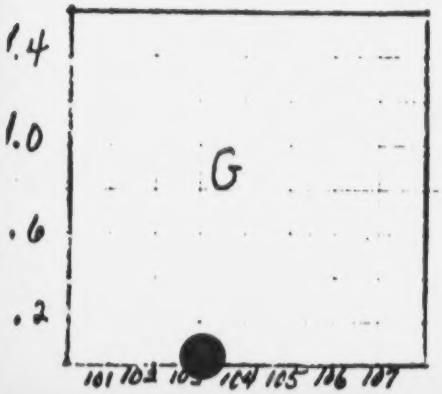



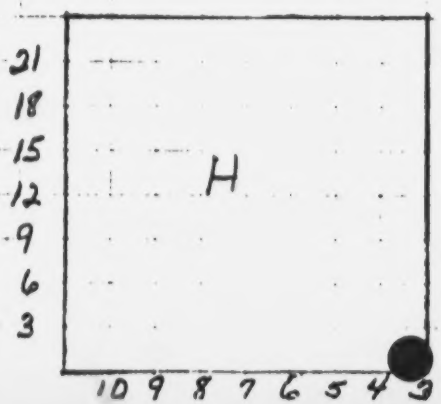



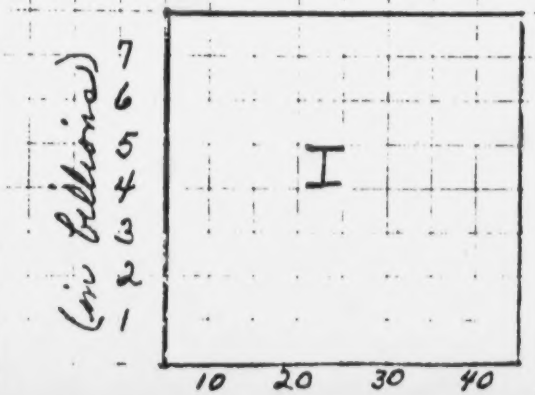




Identifying the graph. Put its letter on the line.

___ Y axis numbered backward

___ X axis does not begin with 0

___ Large numbers: put unit into words

___ X axis not in sequence

___ Y axis not in even intervals

___ X axis crowded, turn sideways

___ X axis crowded, skip every other number

___ X axis numbered backward

___ Correct numbering

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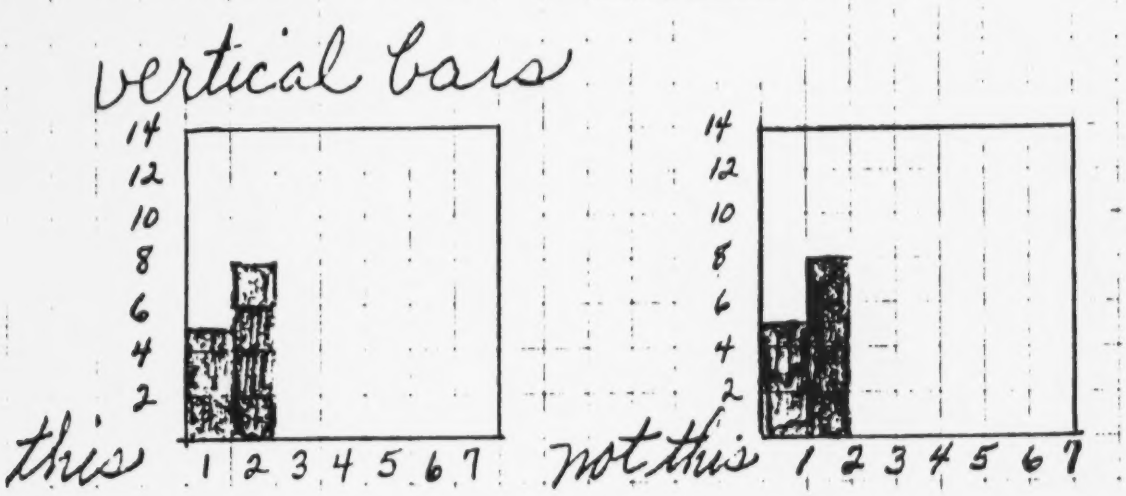
71

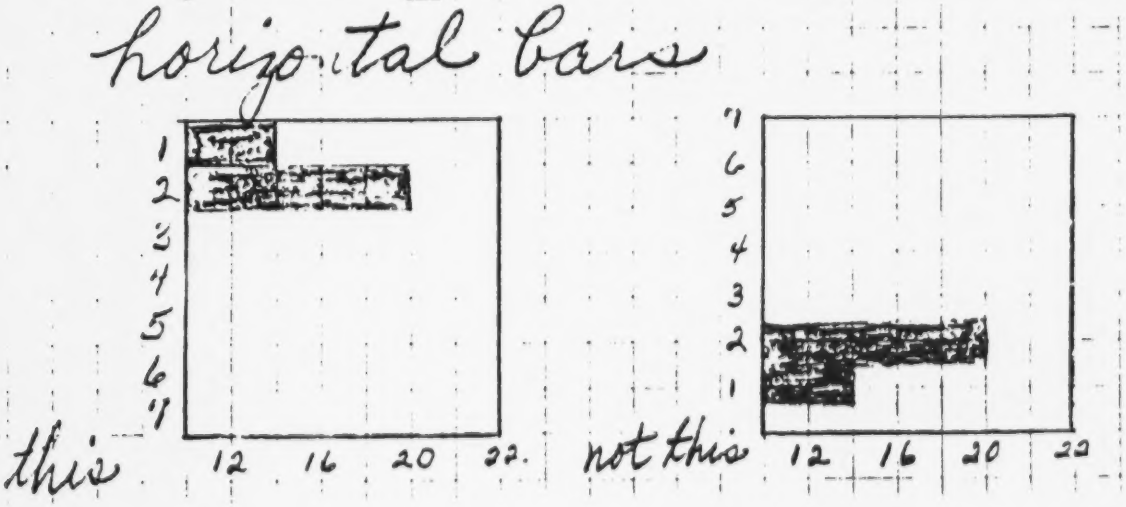
# NUMBERING BAR GRAPHS

All rules for line graphs apply except for the following

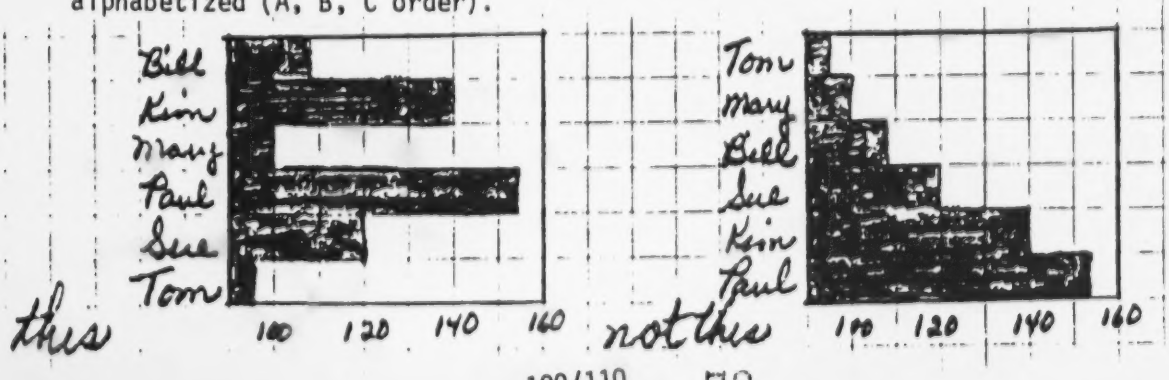
1. For vertical graphs the X axis numbers go in spaces not on a line.



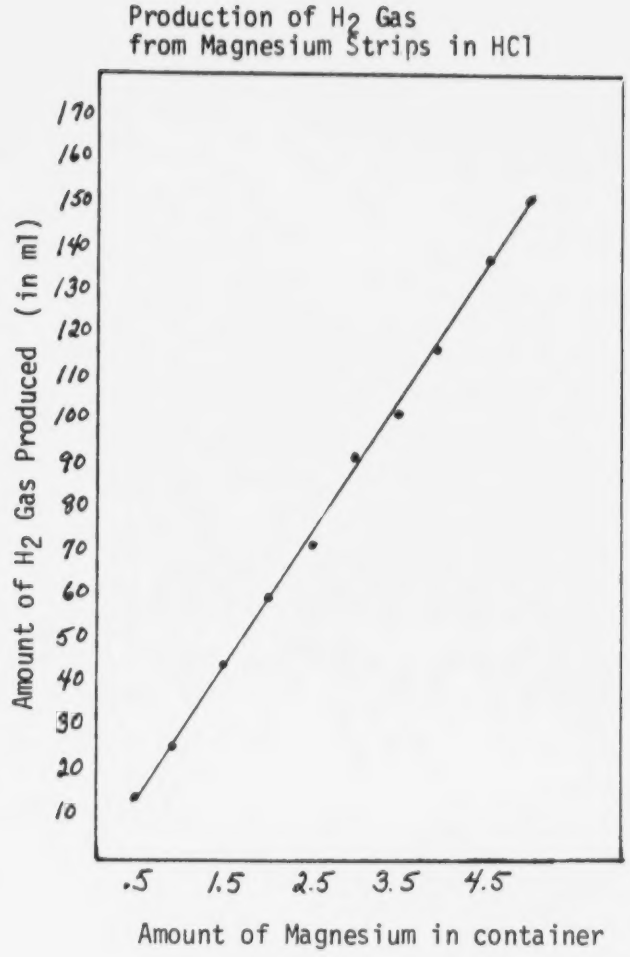

2. For horizontal bar graphs the Y axis numbers go in spaces not on a line.



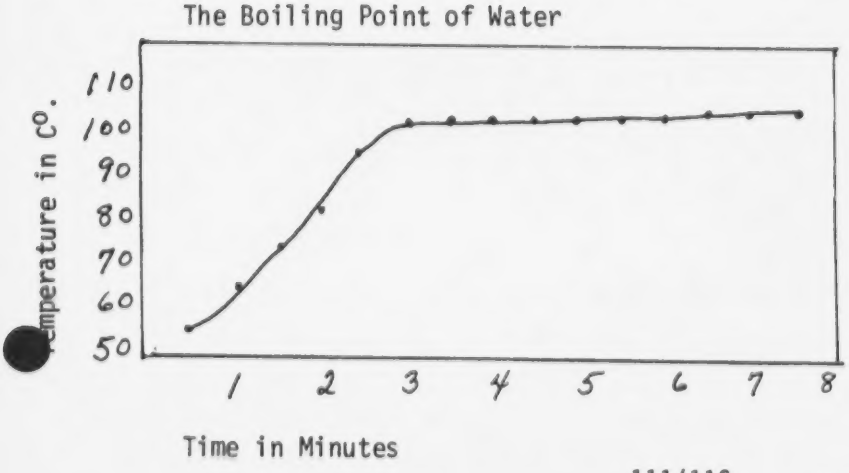

3. Often in bar graphs, names of places, people or things are used from top to bottom or left to right. These names are usually alphabetized (A, B, C order).



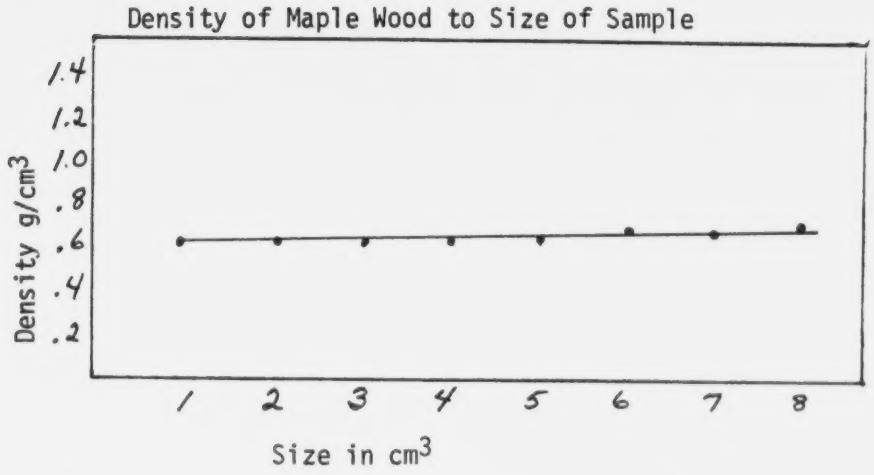
WHAT DO THESE GRAPHS SAY?



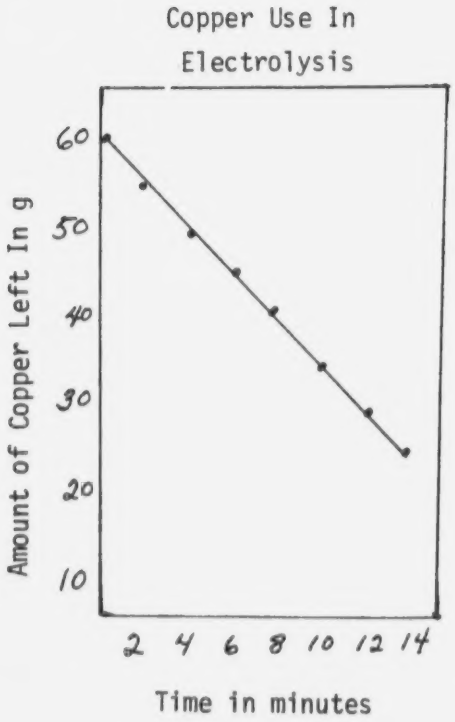

The more _____ is used the more _____ is produced. There is a direct relationship between the amount of _____ used and the amount of _____ produced.




The temperature of water _____ until _____°C. then it levels off and does not rise again. The boiling temperature of water is _____°C.

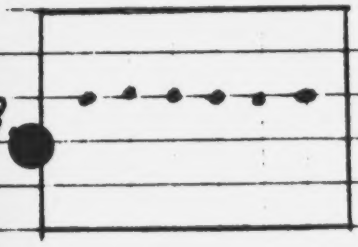
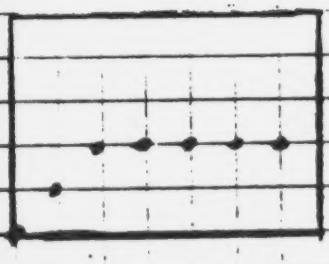



The _____ of the pieces of maple wood does not affect the _____ of the samples. The density of these maple wood pieces is _____ $g/cm^3$.




As the _____ increased the amount of _____ left decreased. The copper left is _____ proportional to the time.

# What Graphs Say

| graph | name | meaning |
|---|---|---|
| 1. | indirectly proportional | The more we get the less we have<br>When shopping for Christmas gifts, the more gifts we get, the less money we have left |
| 2. | directly proportional | The more we get the more we have.<br>When getting gifts of money for a birthday, the more gifts mean the more money we get |
| 3  | no effect | The independent variable does not change the dependent variable<br>Spending as fast as one earns leads to no debts and no future savings |
| 4.  | leveling off | There is a relationship but it stops at a point<br>When water is heated in an open container, its temperature does not exceed 100° C |
| 5. | peaking and tapering | A direct increase to a point then a decrease.<br>The temperature of burning wood increases to a maximum, before the fire and temperature decrease drastically |

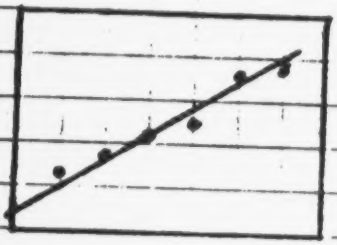
# What Graphs Say (continued)

6.

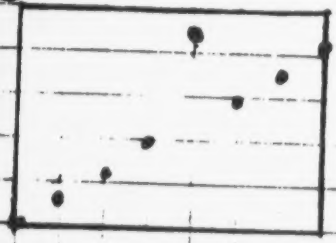
scattered

The dependent variable is not related or effected by the independent variable.

The weight on an apple to the Right of the tree it came from.

7. 

Data during experiments often does not make perfectly straight lines. Look for one of the six patterns.

8. 

one bit of data does not fit the other bits of data

important because

1. may be a mistake
2. may be showing an unusual happening
3. may be correct (a special but regular happening)

An experiment giving this graph should be repeated

TABLES AND GRAPHS AS PART OF THE SCIENTIFIC PROCESS

Example I
Thinking - hypothesizing

Max thinks that the number of charcoal briquets in a grill affects the temperature of the fire.

Doing 1. He controls the amount of air, the placement of the thermometer (60 centimeters above the middle of the pile) and the time of the reading (30 minutes after lighting the briquets).

2. He measures the temperature of the fire varying from 1 to 6 briquets.

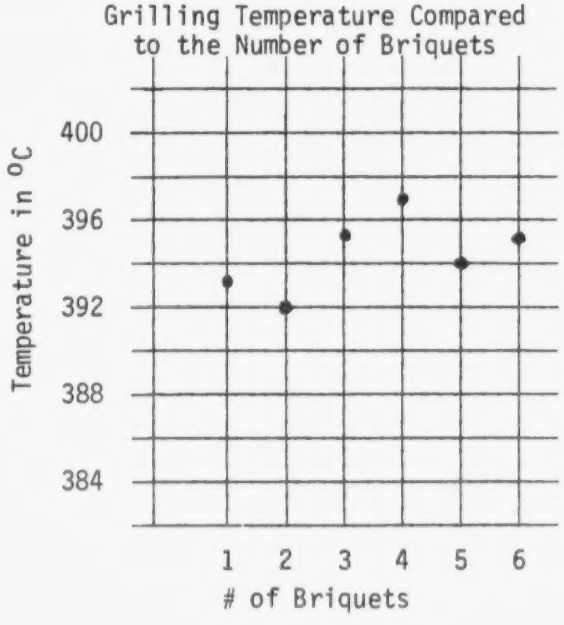
3. He records (writes) the data (the information).

4. He constructs (draws) a graph of the data collected.

Grilling Temperature Compared to the Number of Briquets

| Number of Briquets | Temperature in °C |
|---|---|
| 1 | 393 |
| 2 | 392 |
| 3 | 395 |
| 4 | 397 |
| 5 | 394 |
| 6 | 395 |

DATA TABLE




GRAPH

Thinking A. Analysis of the data. (To examine carefully and in detail.)
B. Conclusion ( A decision reached by thinking about the data.)

The graph shows no significant relationship between the number of briquets and the temperature.

Max must reject his hypothesis. Perhaps if he thinks some more or reads more he may investigate the possible relationship between the number of briquets and the amount of heat in calories.

Example II

Thinking - hypothesizing

John thinks that the amount of oxygen needed to burn a log is related to the size of the log

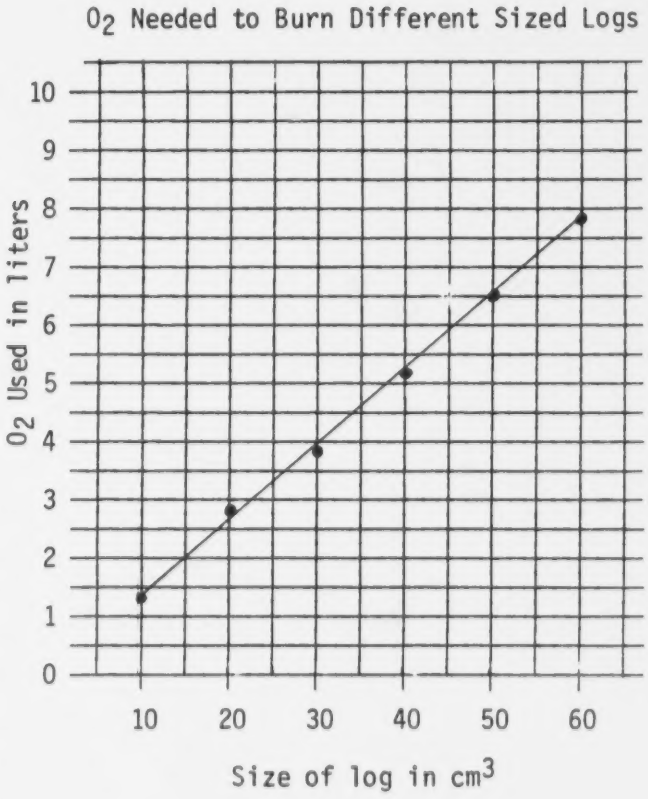
Doing - 1. He controls the size of the logs (the independent variable) by cutting different sized logs.

2. He measures the amount of the $O_2$ used when burning each size.

3. He records (writes down) the amounts of $O_2$ for each size of log in a data table.

4. He then makes a graph of the recorded data.

| Size of Log in $cm^3$ | Amount of $O_2$ in l |
|---|---|
| 10 | 1.3 |
| 20 | 2.7 |
| 30 | 3.9 |
| 40 | 5.2 |
| 50 | 6.5 |
| 60 | 7.8 |




Thinking - A. analyzing (to examine carefully and in detail) the data.
B. forming a conclusion (a decision reached by thinking about the data).

The graph show a direct relationship between log size and amount of $O_2$ used. The bigger the log the more $O_2$ is required to burn it.

John's hypothesis is confirmed. (His thinking was proved correct.)

## CONSTANTS AND VARIABLES

constant - an item that remains the same
Examples of items that are constant:
your date of birth
the number of seconds in a minute
$\pi$ (pi) = 3.14 - the ratio of the circumference of any circle to its diameter
the density of pure water
the speed of light

variable - an item that can change
Examples of items that can change:
temperature
mass and weight
the pitch of a sound
the speed of an airplane
the tightness of a string

independent variable - an item that changes on its own

dependent variable - an item that changes as the independent variable changes

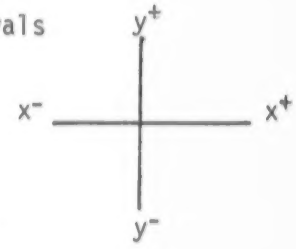
interval - the space or time between things

quadrant - one of 4 equal parts a plane which is divided by the crossing of perpendicular lines

axis - a straight line used for arranging parts into regular intervals

X axis - a horizontal line $x^-$ ——— $x^+$ that crosses the Y axis

Y axis - a vertical line $y^+$ / $y^-$ that crosses the X axis

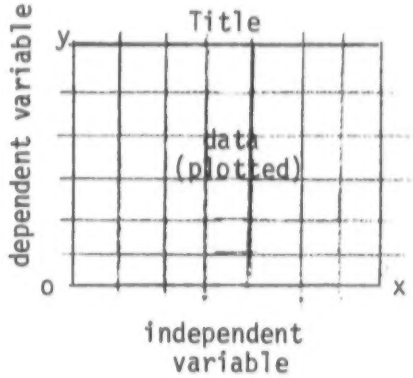



data - information obtained from an experiment

Title

| Independent Variable | Dependent Variable |
|---|---|
| data | data |

data table




graph

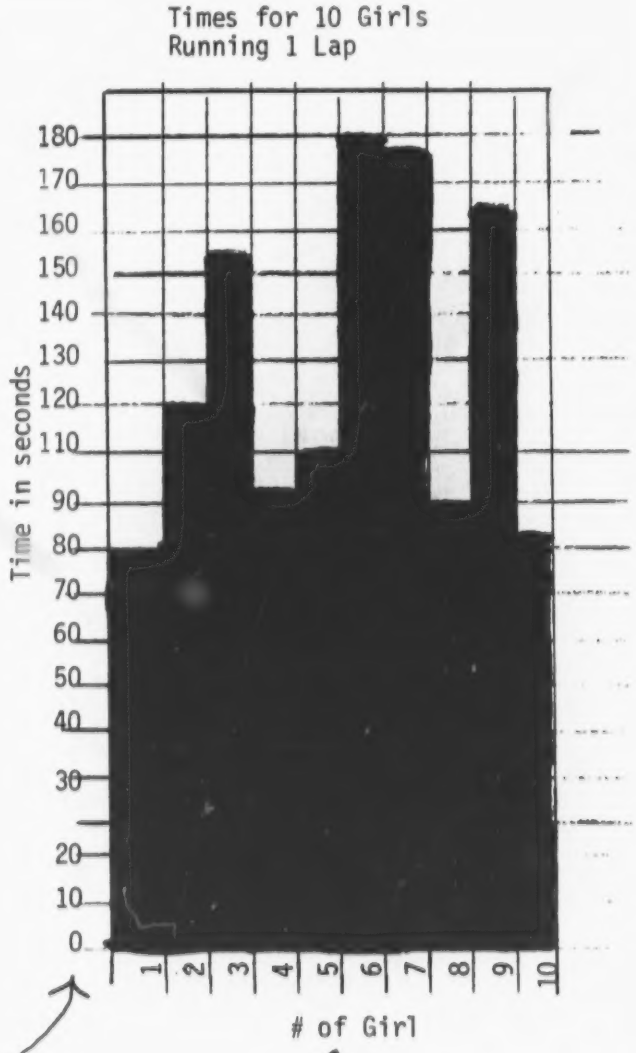
Ten girls run around the football field. Each girl gets to the finish line in a different amount of time. The distance is the same for all ten girls so the distance is a constant. The time each girl needs to run around the field changes or varies, so the time is a variable. How long it takes a girl to run around the field depends on how fast each girl can make herself run, so the girl is a variable. Because the girl can choose how fast she wants to run, the girl is an independent variable. The time is a dependent variable depending on how fast the girl decides to run.

Times for 10 Girls
Running 1 Lap

| Girl | Time in Seconds |
|---|---|
| 1 | 86 |
| 2 | 121 |
| 3 | 153 |
| 4 | 101 |
| 5 | 108 |
| 6 | 180 |
| 7 | 177 |
| 8 | 98 |
| 9 | 164 |
| 10 | 90 |

independent variable

dependent variable



# IDENTIFYING VARIABLES

Almost every Sunday Sophia's mother telephones New York to talk to her sister. Sometimes the call is short and sometimes it is very long. No one else in the family makes long distance calls. Sophia's mother always feels happy when she calls her sister, but she feels sad when she gets the phone bill. Last month her sister traveled to Europe so Sophia's mother did not make any long distance calls. Her phone bill was very low.

Find these items in the above paragraph.

the independent variable _____

the dependent variable _____

a constant _____

what two items are related _____

What depends on what?

1. John eats twice as much as Mary.

   _____ is dependent on _____

2. When Aunt May buys 1 candy bar for my cousin Joe, she buys 3 for the three children in my family.

   _____ is dependent on _____

3. The older the tree the thicker the tree trunk.

   _____ is dependent on _____

4. Only ½ of the seeds planted sprouted and became plants.

   _____ is dependent on _____

5. For every puff of air into a balloon the balloon gets larger.

   _____ is dependent on _____

6. The more gasoline put in the tank of the car the more miles it can go.

   _____ is dependent on _____

7. The less salt in the water the less concentrated the solution.

   _____ is dependent on the _____

8. The faster the water evaporates the less water in the flask.

   _____ is dependent on the _____

9. The faster I eat the quicker my plate is empty.

   _____ is dependent on the _____

10. The weight of a block of wood is increased when the size increases.

    _____ is dependent on the _____

# DEPENDENT AND INDEPENDENT VARIABLES

Remember

variable - an item that can change

independent variable - an item that changes by itself

dependent variable - an item that changes only when the independent variable changes

After reading the information decide what items change.
Then write independent if it changes by itself,
or dependent if it changes only when some other item changes.

A. Michael is 12 years old. Michael eats alot of rice.
Michael's age is _____ of how much rice he eats.

B. Maria used money she had saved to buy her mother a gift. She also bought a gift for her little sister.
The amount of money Maria has left is _____ on the cost of the gifts.

C. Uncle Peter gets paid for every hour he works. He works at the airport. Some airplanes at the airport are very large and some are small.
Uncle Peter's pay is _____ of the size of the airplane but _____ on the number of hours he works.

D. I pour water out of a beaker into 5 test tubes.
How much water is left in the beaker is _____ on how much water I poured into the 5 test tubes.

E. The teacher writes on the board with white chalk. After one week the chalk is used up.
The color of the chalk is _____ of how much the teacher wrote but the size of the chalk is _____ on how much it was used.

F. A clock ticks once every second. It ticks 60 times every minute.
The number of ticks is _____ on the amount of time passing.

G. Jerome sells candy at his father's store. Half the customers that come into the store buy candy.

How much candy Jerome sells is _____ of how much candy he has, but is _____ on the number of customers that come into the store.

H. I play my guitar on Friday and Saturday nights for my cousins to dance to. The big thick strings on my guitar give low sounds and the small thin strings give high sounds.

How high the sound is is _____ of the thickness of the string and is _____ of the day of the week.

ANSWER KEY IDENTIFYING VARIABLES:

A length and/or number of calls

B amount owed on phone bill

C Mother's calls to sister (Sundays)

D length of calls and amount owed

1. quanity John eats to quantity Mary eats
2. When my family gets candy to when Aunt Mary buys cousin Joe candy
3. thickness to age of tree
4. sprouted plants to seeds planted
5. size of balloon to number of puffs of air
6. miles a car goes to amount of gasoline
7. solution concentration to amount of salt in the water
8. amount of $H_2O$ in flask to speed of evaporation
9. amount of food left to speed I eat
10. weight of block to size of block

ANSWER KEY DEPENDENT AND INDEPENDENT VARIABLES

I = independent D = dependent

1. I
2. D
3. I
4. D
5. D
6. I
7. D
8. D
9. I
10. D
11. D
12. I

UNIT III

CHEMISTRY

The materials in the Chemistry section of this guide presents teachers with a variety of techniques with which to aid ESOL students.

Units covered in Chemistry

A. Matter

B. Atoms

C. Elements

D. Compounds

E. Mixtures

F. Energy

G. Wave Theory

H. Light

I. Color

J. Heat

K. Sound

L. Magnetism

M. Electricity

# MATTER

Words to Know:

1. Mass - The amount of matter in an object.
2. Matter - Takes up space and has mass.
3. Space - The area inside of something.
4. Solid - One kind of matter. It has a shape that does not change and it takes up space. Has volume.
5. Definite Shape - The way a thing looks because of its outline.
6. Liquid - One kind of matter that takes up space but has no shape of its own. Has definite volume.
   Examples: water, juice, milk.
7. Gas - One kind of matter that does not have a shape of its own or a definite volume.
8. Energy - Anything that makes something move.
9. Measure - To compare temperature, length, or weight to another.
10. Temperature - The measure of hot or cold. How hot something is.
11. Boiling - To heat a liquid until it bubbles.
12. Conservation of Mass - Matter can not be made of destroyed.
13. Melting - Change from a solid to a liquid.
14. Freezing - To change to a solid because of cold.
15. Evaporate - Water changed to a gas or steam.
16. Thermometer - A glass tube marked in degrees for measuring temperature.

Name _____

# MATTER

Activity I

Matching - Choose the correct letter. Write it on the line.

| | | | |
|---|---|---|---|
| _____ 1. | Evaporate | A. | Examples of Matter. |
| _____ 2. | Shape | B. | A way a thing looks because of its outline. |
| _____ 3. | Matter | C. | Anything that makes something move. |
| _____ 4. | Iron and water | D. | No shape of its own - but takes up space, and has volume. |
| _____ 5. | Liquid | E. | Anything that has mass and takes up space. |
| _____ 6. | Gas | F. | Water changed to a gas or steam. |
| _____ 7. | Freeze | G. | To change to a solid because of cold. |
| _____ 8. | Melt | H. | Matter that has no shape of its own and no definite volume. |
| _____ 9. | Energy | I. | Change from a solid to a liquid. |
| _____10. | Boil | J. | To heat a liquid until it bubbles. |

Matter - Facts To Know:

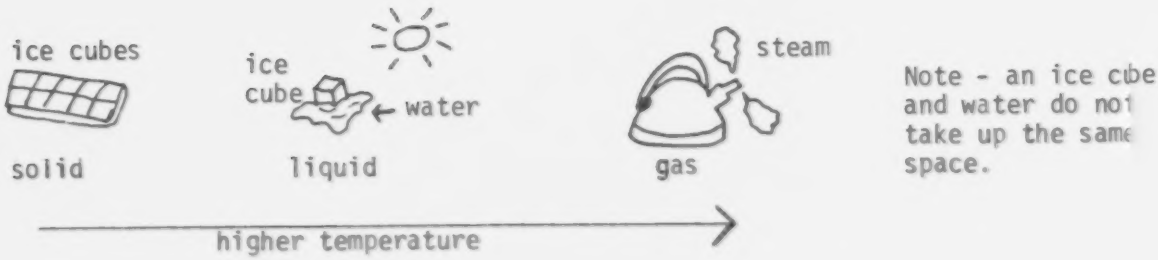
What is everything that you see, feel, taste, and touch? Scientists say everything in the world can be called matter. Matter is anything that needs space to be in and has mass. All solids, liquids, and gases are matter. Matter has weight.

All solids have a definite shape by themselves and take up space. Examples of solids are glass, a rock, a cookie, a pen, and even yourself.

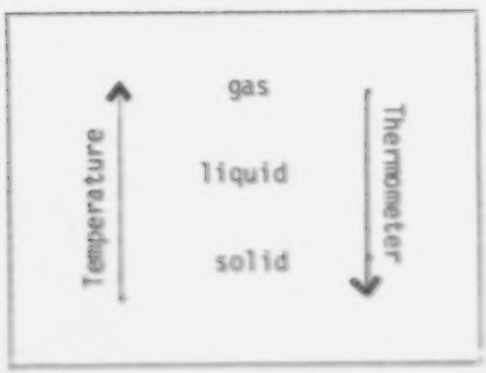
A liquid takes up space but has no shape of its own. It spreads out and takes the shape of its container.

Gases are always moving. They can expand and contract. Gases can take up space.

No two pieces of matter can take up the same space at the same time. One thing moves to let the other thing have its space. An example occurs when water moves as a fish takes up space in water.




Note - an ice cube and water do not take up the same space.



Name _____

Matter - Facts to Know - Activity II

Complete these sentences:

1. Scientists say everything in the world can be called _____.
2. Matter is anything _____

   _____.
3. All _____, _____ , and _____

   are matter.
4. All solids have a definite _____ and _____

   _____.
5. Examples of solids are: _____

   _____.
6. A liquid takes up space but has no _____.
7. Gases are asways _____.
8. Gases can take up _____.
9. No two pieces of matter can take up the _____

   _____
10. One thing moves to _____

    _____.

Name _____

Matter - Activity III

Complete sentences using these words. (May use more than once.)

| | |
|---|---|
| matter | liquid |
| solids | space |
| scientists | weight |
| mass | container |
| shape | gases |
| moving | can |
| | same |

_____ say everything in the world can be called _____. Matter is anything that needs _____ to be in and has _____. All _____, _____, and _____ are matter. Matter has _____.

All solids have a definite _____ and take up space.

A liquid takes up _____ but has no shape of its own. It takes the shape of its _____.

Gases are always _____. Gases _____ take up space.

No two pieces of _____ can take up the same space at the _____ time.

Name _____

Matter - Activity IV

List examples under each category:

Solids (sample: - wood)

1.

2.

3.

4.

5.

Liquids (sample: water)

1.

2.

3.

4.

5.

Gases (sample: oxygen)

1.

2.

3.

4.

5.

Name _____

Lab - Matter - Activity V

Title - To see if air takes up space

Purpose - Does air take up space?

Hypothesis - Choose one:

A. Yes, air takes up space.

B. No, air does not take up space.

Materials - 1. drinking glass

2. large bowl or container

3. water

4. piece of paper

Procedure -

1. Fill a large bowl halfway with water.

2. Stuff a piece of paper into a small glass. Push it all the way to the bottom.

3. Turn the glass upside down.

4. Hold it straight.

5. Put it into the bowl. Hold it there for a short time.

6. Lift the glass out.

7. Look at the paper in the glass.

Observation - (what appenes?) _____

Conclusion -

Does air ake up space?

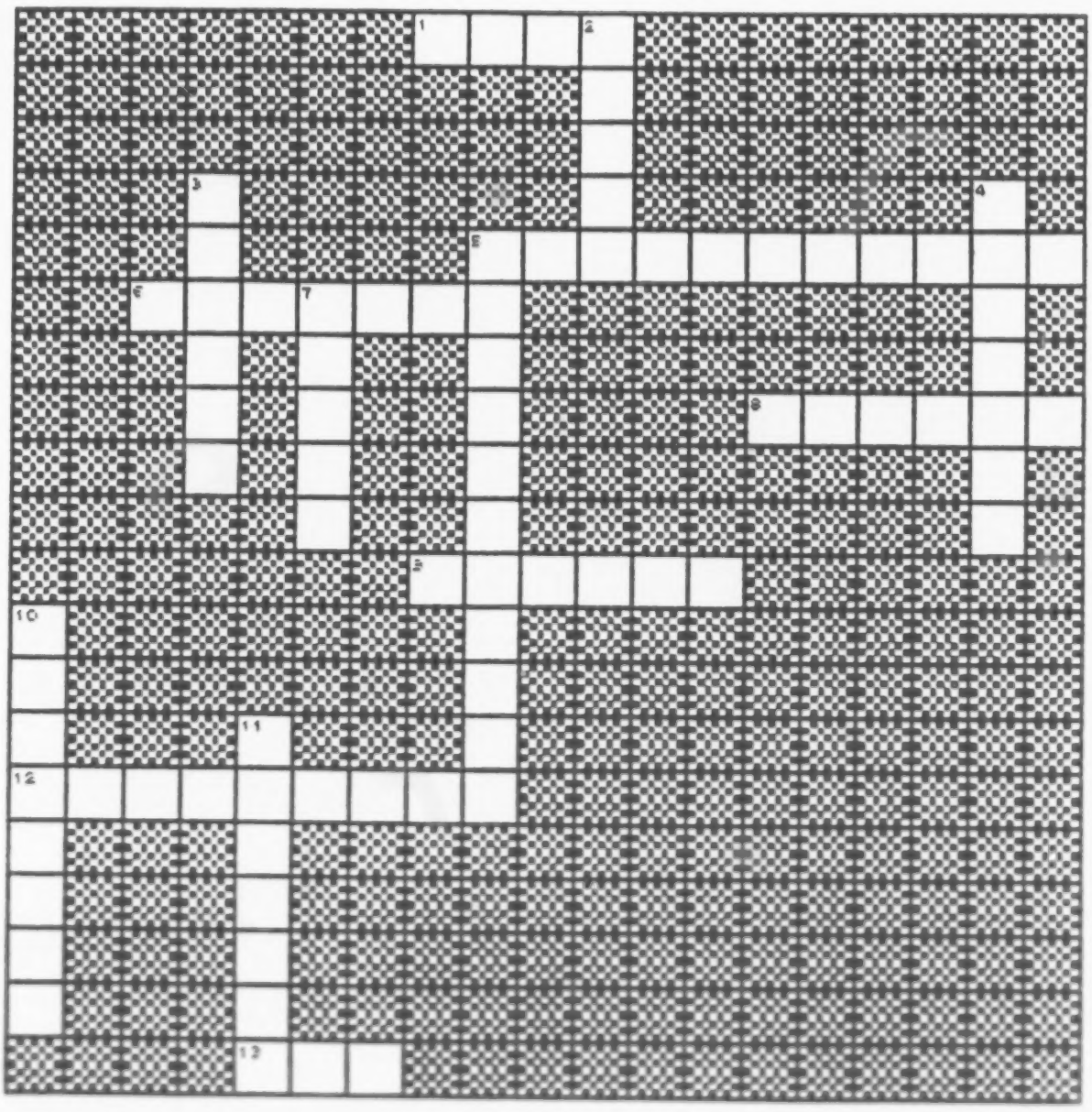
_____

Questions -

1. Did te paper get wet? _____

2. Can to things take up the same space at the same time?

TYPES OF MATTER



ACROSS CLUES

1. The amount of matter in an object
5. A glass tube marked in degrees for measuring temperature.
6. To compare temperature, length, or weight to another.
8. Kind of matter that takes up space but has no shape of its own
9. Anything that takes up space and has mass.
12. Water changed to a gas or steam.
13. Kind of matter that does not take up space or has a shape of its own. It does have mass.

DOWN CLUES

2. The area inside of something.
3. Anything that makes something move.
4. A change from a solid to a liquid
5. The measure of how hot or cold something is.
7. Kind of matter that has a shape
10. To change to a solid because of cold.
11. To heat a liquid until it bubbles.

# ATOMS

Words to Know:

1. Atom - The smallest part of matter of which chemical elements are made.

2. Nucleus - The center part of an atom.

3. Proton - A part of an atom found inside the nucleus. A proton has a positive electrical charge (+).

4. Neutron - A part of an atom found inside the nucleus. A neutron has no electrical charge (-).

5. Electron - A part of an atom that moves around the nucleus; an electron has a minus (negative) electrical charge ( -). An electron is very small.

6. Atomic weight - (mass) The number of protons added to the number of neutrons is the atomic weight in the atom.

7. Atomic number - The number of protons or electrons in an atom.

8. Molecule - One or more of the same atom that are together; the smallest part of a substance that can live alone without changing its chemical form.

9. Electrical Charge - Not enough or too many electrons.
   Positive electrical charge = (+) = not enough electrons.
   Negative electrical charge = (-) = too many electrons.

An atom and its electrons

Name _____

Atoms - Activity I

Put the following words in alphabetical order (ABC)

| | |
|---|---|
| Nucleus | 1. |
| Atom | 2. |
| Proton | 3. |
| Neutron | 4. |
| Electron | 5. |
| Atomic Weight | 6. |
| Molecule | 7. |
| Atomic Number | 8. |
| Mass | 9. |
| Charge | 10. |

* To improve reinforcing skills - after the student has alphabetized, have student look up the words or some of the words in their book's glossary.

Name _____

Atoms - Activity II

Matching - Write the correct letter on the line next to each number.

| | |
|---|---|
| _____ 1. Protons and neutrons | A. Number of protons in an atom. |
| _____ 2. Electrons | B. Make up of a nucleus. |
| _____ 3. Protons | C. Have no charge. |
| _____ 4. Neutrons | D. Have a positive charge (+) |
| _____ 5. To find atomic weight | E. Have a negative charge (-) |
| _____ 6. To find atomic number | F. Smallest part of matter. |
| _____ 7. Atoms | G. One or more of the same atom. |
| _____ 8. Molecule | H. Add an atom's protons and neutrons |

Name _____

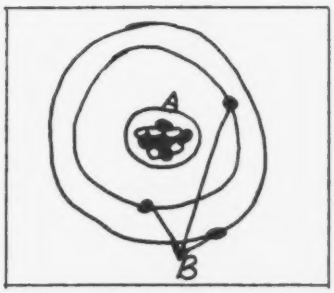
Atoms - Activity III

Determine the atomic weight and atomic number of the following.

| | What is the atomic weight? | What is the atomic number? |
|---|---|---|
| Example: If an atom has: 2-protons, 2-neutrons | 4 | 2 |
| 1. If an atom has: 3-protons, 4-neutrons | 1. | |
| 2. If an atom has: 5-protons, 5-neutrons | 2. | |
| 3. If an atom has: 8-protons, 7-neutrons | 3. | |
| 4. If an atom has: 12-electrons, 12-neutrons | 4. | |
| 5. If an atom has: 4-protons, 6-neutrons | 5. | |
| 6. If an atom has: 11-protons, 10-neutrons | 6. | |
| 7. If an atom has: 24-protons, 23-neutrons | 7. | |
| 8. If an atom has: 16-neutrons, 16-protons | 8. | |
| 9. If an atom has: 34-neutrons, 35-electrons | 9. | |
| 10. If an atom has: 45-neutrons, 45-protons | 10. | |

Name _____

Understanding an Atom - Activity IV




Look at the picture. Answer the Questions.

1. The nucleus is labeled _____ (A or B).

2. The electrons are labeled _____ (A or B).

3. The center of the atom is called a _____.
   a. neutron
   b. proton
   c. nucleus

4. Name the two parts of a nucleus.

   _____ and _____

5. A proton is _____ than an electron.
   a. larger
   b. smaller

6. An electron is _____ than a neutron.
   a. larger
   b. smaller

7. A neutron has _____ charge.
   a. a positive
   b. a negative
   c. no

8. An electron has _____ charge.
   a. a positive
   b. a negative
   c. no

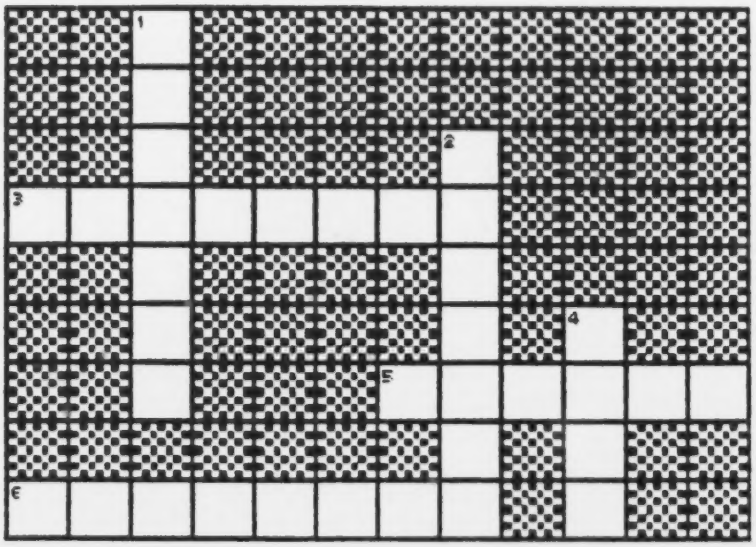
9. A proton has _____ charge.
   a. a positive
   b. a negative
   c. no

10. How many electrons are in the picture?

    _____.

    a. 2
    b. 3
    c. 4

VOCABULARY ON ATOMS



ACROSS CLUES

3. One or more of the same atom that are together. The smallest part of a substance.
5. A part of an atom found inside the nucleus. Has a + charge.
6. A part of an atom that moves around the nucleus. Has a - charge

DOWN CLUES

1. The center of the atom.
2. A part of an atom found inside the nucleus. Has no charge.
4. The smallest part of matter of which chemical elements are made

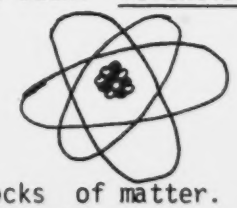
ELEMENTS

Facts to Know:

There are millions of different kinds of molecules. There are 106 different kinds of atoms. Each kind of atom is called an element. Every kind of matter is made up of one or more of these 106 kinds of atoms. Oxygen, gold, iron, silver and copper are a few of these elements.

Most matter is made up of two or more kinds of atoms. Matter that is made up of only one kind of atom is called an element.

Atoms are too small to be seen. Scientists think an atom looks like this.



Elements are building blocks of matter. Elements can be combined with other elements. Many combinations are possible. Electrical charge of the elements determine how they combine.

The arrangement of atomic number of each element is on the periodic table. The atomic weight is the weight of protons and neutrons of an element.

Chemical symbols are a fast way to write the name for an element. The symbols used in compounds are called formulas.

* Additional Activity - Have students define underlined words.

# ELEMENTS

Words to Know:

1. Molecules - Consists of one or more atoms. The smallest part of a substance that can exist alone without losing its chemical form.

2. Atoms - The smallest part of matter of which chemical elements are made.

3. Elements - A substance in which every molecule is made up of a single kind of atom.

4. Matter - Anything that takes up space and has mass. Matter can be changed to energy and energy into matter. Solids, liquids, and gases are matter.

5. Combine - To come together, join.

6. Determine - To find out exactly. To settle or decide.

7. Arrangement - Arranging. Putting in order

8. Periodic Table - A chart of all the elements arranged by atomic number from smallest to biggest.

9. Symbols - A mark or sign that stands for another object.

10. Scientist - A person who is an expert in science.

11. Formula - A group of symbols and figures showing the elements in a chemical compound. A short way of writing a compound.

12. Substance - A kind of matter in which every molecule in that matter is the same.

13. Compound - A substance in which the molecules are made up of two or more different kinds of atoms.

14. Mixture - Two or more different kinds of matter mixed together.

Name _____

ELEMENTS - COMPLETION - Activity

Complete the sentences using the following words:

| | | |
|---|---|---|
| formulas | compounds | atoms |
| symbols | molecules | elements |
| millions | weight | matter |
| neutron | proton | more |
| arrangement | number | combinations |
| blocks | periodic table | |
| determine | combined | |

There are _____ of different kinds of _____. There are 106 different kinds of _____. Each kind of atom is called an _____. Every kind of _____ is made up of one or _____ of these 106 kinds of atoms.

Elements are building _____ of matter. Elements can be _____ with other elements. Many _____ are possible. Electrical charge of these elements _____ how they combine.

The _____ of atomic _____ of each element is on the _____ _____. The atomic _____ is the weight of _____ and _____ of an element.

Chemical _____ are a fast way to write the name for an element. The symbols used in _____ are called _____.

Name _____

ELEMENTS - Activity II

Choose the correct letter - write it on the line.

_____ 1. How many different kinds of atoms are there?

A. 100
B. 106
C. 90

_____ 2. What do we call matter that has only one kind of atom?

A. Element
B. Atom
C. Compound

_____ 3. Elements are pure substances. In the list name the element.

A. Table salt
B. Copper
C. Water

_____ 4. What is made up of two or more kinds of atoms?

A. Matter
B. Element
C. Molecule

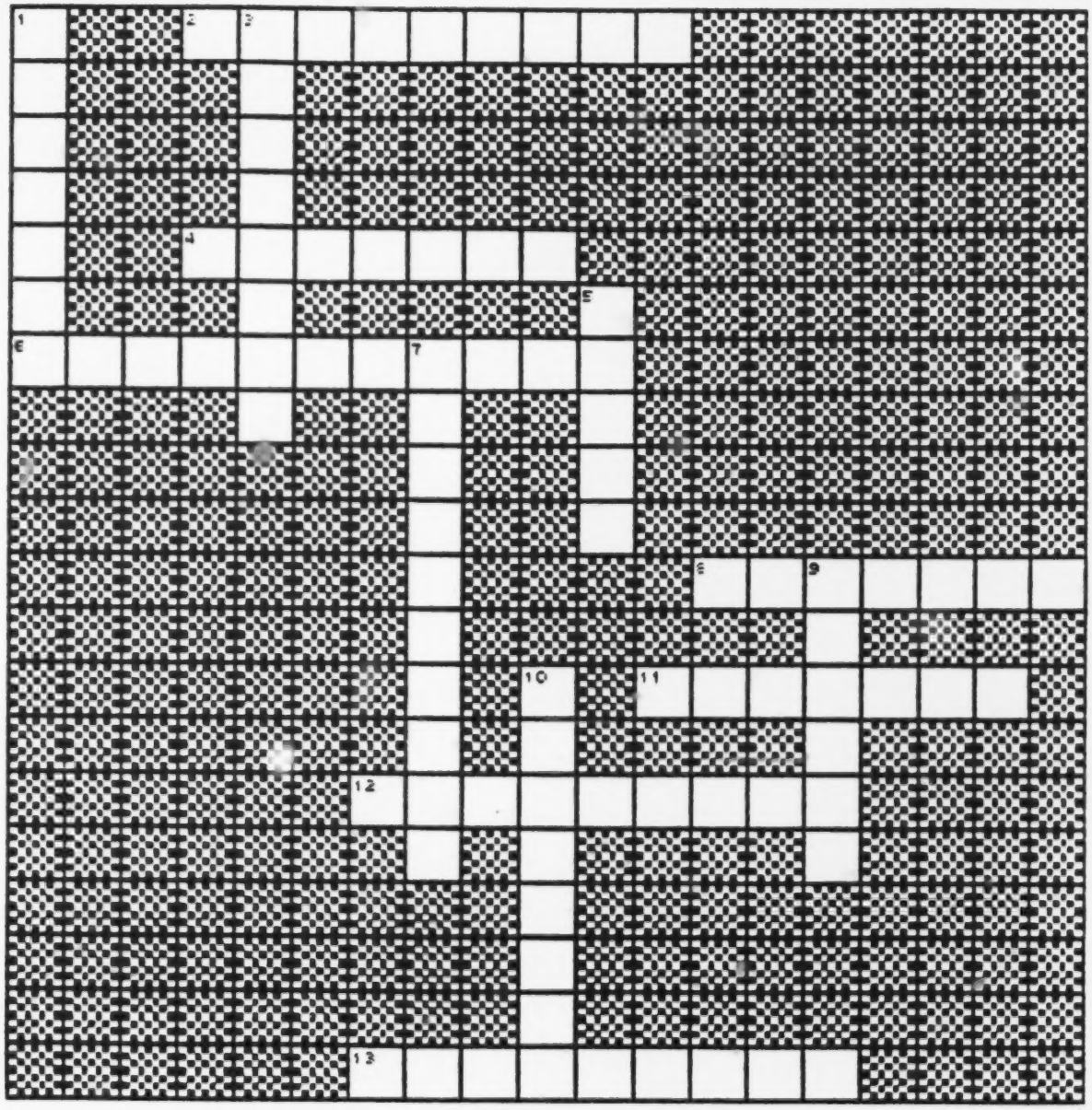
_____ 5. What do we use to write names of elements fast?

A. Symbols
B. Compounds
C. Mixtures

_____ 6. A group of symbols used in writing a compound a short way.

A. Arrangement
B. Periodic Table
C. Formula

VOCABULARY: ELEMENTS



ACROSS CLUES

2. A person who is an expert in science.
4. To come together, join.
6. Arranging, putting in order.
8. A mark or sign that stands for another object.
11. Two or more different kinds of matter mixed together.
12. To find out exactly. To settle or decide.
13. A kind of matter in which every molecule in that matter is the same.

DOWN CLUES

1. A group of symbols showing the elements in a chemical compound.
3. A substance in which the molecules are made up of two or more different kinds of atoms.
5. The smallest part of matter in which chemical elements are made.
7. Consists of one or more atoms.
9. Anything that takes up space and has mass.
10. A substance in which every molecule is made up of a single kind of atom.

# COMPOUNDS

Facts to Know:

A compound is a substance or matter made up of two or more different elements. There are about 106 known elements. Most elements can combine with other elements to form compounds. There are several thousand known compounds.

You use water every day. You know that water is a clear, colorless liquid. Is water an element ar a compound? Water is made of the elements hydrogen and oxygen. Because water is made of different elements it is a compound.

Activity - Read the paragraph then answer these questions.

1. What is a compound? _____

_____

2. What happens when elements combine? _____

_____

3. How many known compounds are there? _____

_____

4. Why is water a compound? _____

_____

* Additional Activity - Have students define underlined words.

# MIXTURES

Facts to Know:

Mixtures occur when two or more kinds of matter are mixed together. The kinds of matter are not combined. They are simply mixed. The molecules in a mixture are not all alike. There may be many different substances in a mixture.

Mixtures do not have chemical formulas. A compound always has the same chemical formula. A mixture does not have the same composition all of the time, it may be different.

Mixtures can be separated or taken apart. The substances in a mixture keep their own properties. In a mixture of salt and water, the salt dissolves. The salt in the water can be separated by heating the solution. The water evaporates, and the salt is left behind.

Answer these questions:

1. When does a mixture occur? _____

_____

2. Are the molecules in a mixture all alike? _____

_____

3. Do mixtures have chemical formulas? _____

_____

4. Can mixtures be separated? _____

_____

* Additional Activity - Have students define underlined words.

# ENERGY

Facts to Know:

Energy is anything that makes something move. Electricity is energy - electricity can make a fan move. Heat is energy. Heat can make warm air move. Heat energy can move trucks, cars, and airplanes. Fire gives off heat. Light and sound are energy. Wind is energy. Running water is energy.

There are seven forms of energy.

A. Heat
B. Light
C. Sound
D. Chemical
E. Atomic
F. Electrical
G. Mechanical

Energy can be stored, or can be used but hasn't. This is called Potential Energy. Wood, oil, gasoline or coal have stored energy. When you burn them, they give off heat and light.

Energy in action is called Kinetic Energy. Potential energy can change to kinetic energy.

Example:

A. A piece of wood lying on the ground is potential energy. It can be changed to kinetic energy by lighting it with a match and burning it to give off heat and light.

B. A rock lying on a ledge has potential energy. When it is knocked off the ledge and falls down it has kinetic energy because it is in motion or action.

C. Take a rubber band. Pull it with both hands. It now has potential or stored energy. Let go with one hand. What happens? It goes into action and hits your other hand.

Energy Conversion is the changing of one form of energy into another form.

Example:

A. Plug in a light. This changes electrical energy to light energy.

B. Now put your hand over the light. Your hand feels hot. The light energy is changed to heat energy.

Name _____

Energy Sources - Activity I

- Energy comes in many forms.
- Some natural sources of energy are wind energy, solar energy, and water energy.
- Wind energy can make windmills turn.

- Solar energy can heat a home. It comes from the sun.
- Water energy is seen in waterfalls and ocean waves.
- Examples of chemical energy: Coal, natural gas and petroleum.

coal

oven uses natural gas

petroleum

1. Are there only natural sources of energy?

_____

2. What are some natural sources of energy?

_____

3. Where does solar energy come from?

_____

4. What are some examples of chemical energy?

_____

Name _____

Energy - Activity II

Complete the chart - Use heat, light, sound, chemical, atomic, electrical, or mechanical energy.

| What kind/s of energy would you be using in: | |
|---|---|
| 1. Cooking | |
| 2. Hearing a car horn | |
| 3. Riding a bicycle | |
| 4. Burning a candle | |
| 5. Turning on a lamp | |
| 6. Turning on a radio | |
| 7. Lighting a match | |
| 8. Nuclear power plant | |
| 9. Turning on a car engine | |
| 10. Banging a drum | |

# WAVE THEORY

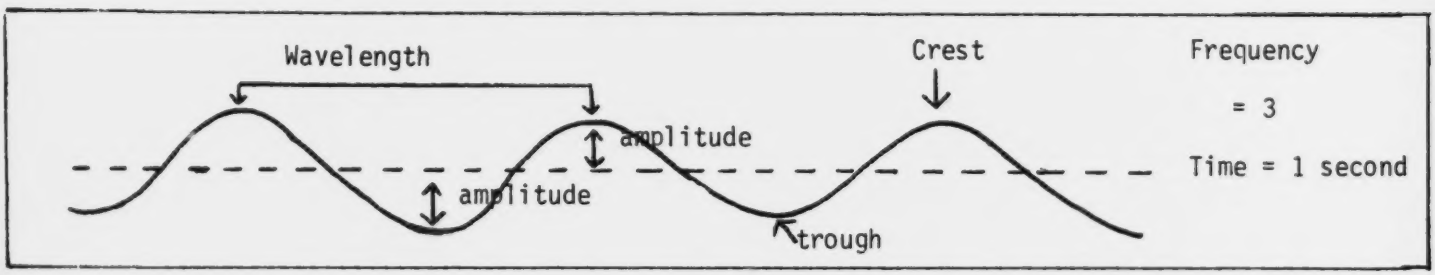
Facts to Know:

Waves come in many forms:

A. Ocean waves
B. Sound waves
C. Shock waves

Examples of Waves:

D. You can wave a flag.
E. Waves are made when a rock is thrown into water.
F. You can wave good-bye to someone.
G. Waves can be made in a spring.




Vocabulary to Know:

1. Wave - Means to arrange in a pattern of curves.
   - Waves move energy from place to place.

2. Wavelength - The distance from any point in a wave to the same point of the next wave.

3. Amplitude - Distance a wave rises or falls as it travels
   - Half the distance from the bottom of the trough of a wave to the top of a crest of a wave.

4. Frequency - The number of waves that pass in a given time.

5. Crest - The highest point of a wave.

6. Trough - The lowest point of wave.

7. Transverse wave - A wave which seems to move up and down and across a surface.
   Example: water waves

8. Speed of a wave - How fast a wave moves. Multiply frequency by wave length.

9. Reflection - The bouncing back of a wave.

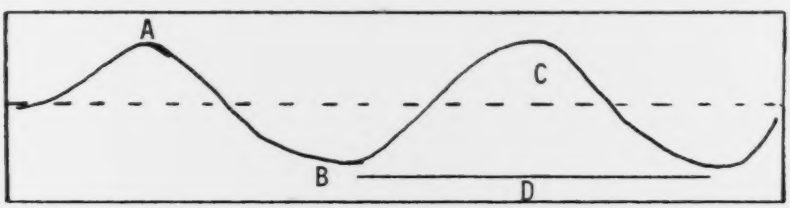
10. Refraction - A change in direction of moving waves.

Name _____

Waves - Activity I

Name the parts of a wave

I




A. _____

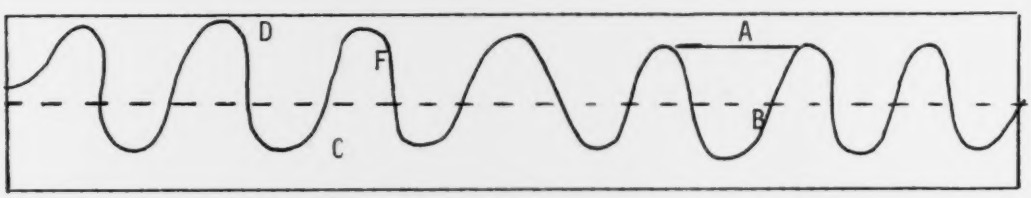
B. _____

C. _____

D. _____

E. Frequency of this wave = _____

II




A. _____

B. _____

C. _____

D. _____

E. Frequency of waves = _____

F. _____

Name _____

Waves - Matching - Activity II

Match the correct letter to the number

| | |
|---|---|
| _____ 1. Wave | A. The bouncing back of a wave. |
| _____ 2. Wavelength | B. The highest point of a wave. |
| _____ 3. Amplitude | C. How fast a wave moves. S = F x 2 |
| _____ 4. Frequency | D. Number of waves in a given time. |
| _____ 5. Crest | E. Means to arrange a pattern of curves. |
| _____ 6. Trough | F. Distance a wave rises or falls. |
| _____ 7. Transverse wave | G. A change in direction of moving waves. |
| _____ 8. Speed of a wave | H. The lowest point of a wave. |
| _____ 9. Reflection | I. Distance from top of one wave to next wave. |
| _____10. Refraction | J. A wave which seems to move up and down and across |

* Additional Activity - Have students write a short paragraph on how waves act at the ocean from what they have learned.

Wave Lab Activity

Title - To see if waves can be made with a rope

Purpose - (Question) - Can waves be made with a rope?

Hypothesis - (Answer Question) - Choose one:

A. Yes, waves can be made with a rope.

B. No, waves can not be made with a rope.

Materials - (What you need)

1. long rope
2. table
3. watch or clock

Procedure - (What to do)

1. Tie a long rope to some fixed object, example, a table.
2. Make waves with a rope by moving the rope up and down.
3. Count how many waves you make in one (1) minute.
4. Divide this number by sixty (60) to find the frequency of waves you made.

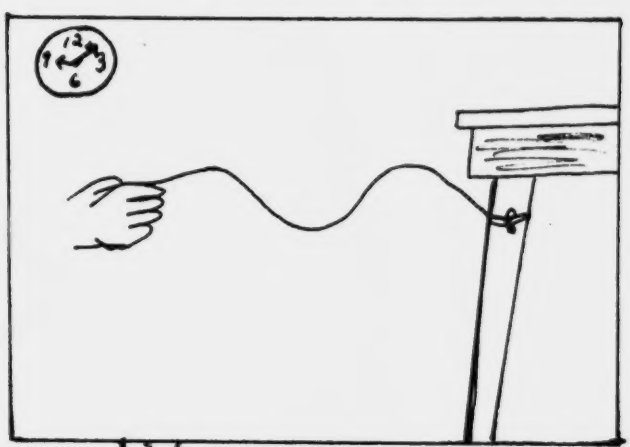
Observation - (What you saw)

| Number of waves in 1 minute ÷ | 60 | = Frequency |
|---|---|---|
| | | |

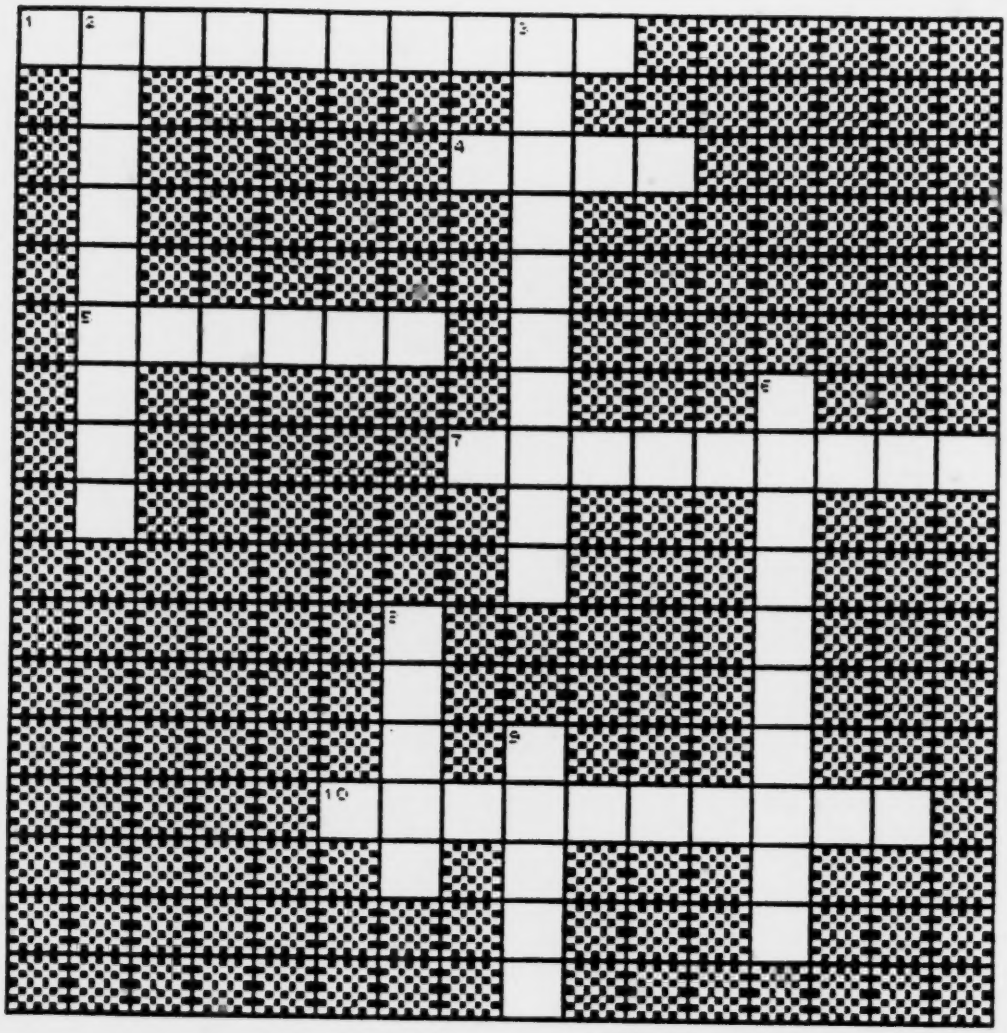
Conclusion - Choose the correct answer

A. Yes, my hypothesis is true.

B. No, my hypothesis is false.



WAVE THEORY



ACROSS CLUES

1. The distance from any point in a wave to the same point of the next wave.
4. Means to arrange in a pattern of curves.
5. The lowest point in a wave.
7. The number of waves that pass in a given time.
10. A change in direction of moving waves.

DOWN CLUES

2. Distance a wave rises or falls as it travels.
3. A type of wave which seems to move up and down and across a surface.
6. The bouncing back of a wave.
8. How fast a wave travels.
   Speed = wavelength X frequency
9. The highest point of a wave.

# LIGHT

Words to Know:

1. Lantern - A light or a lamp.
2. Appear - Seems to be there
3. Object - thing
4. Radiation - The loss of energy in rays or waves.
5. Radiant Energy - Light rays are a form of radiant energy.
6. Electromagnetic wave - any radiant energy wave
7. Visible - you can see it
8. Transparent - Light can pass through it.
9. Opaque - Light cannot pass through it.
10. Luminous object - An object that gives off its own light.
11. Nonluminous object - An object that does not give off its own light.
12. Reflection - Bouncing back.
13. Refraction - Changing the direction of light by bending it.
14. Rays - Lines of light.
15. Direction - The line where something moves.
16. Corner - Place where two surfaces come together (angle).
17. Bend - To be curved.
18. Bounce - To hit a surface and come back.
19. Surface - The outside of a thing.
20. Mirror - A smooth surface that reflects light or an image.

# LIGHT

Facts to Know:

Read the Lesson, then look up the underlined words in the dictionary.

Light is energy. Most light comes from the sun. Light helps plants grow. Light travels fast. Light travels 186,000 miles a second.

Light travels in straight lines. The lines are called rays. Rays go out in all directions. Light is Radiant Energy. Light rays cannot turn a corner. But they can bend.

Light rays seem to bend a straw.

Light rays bounce when they hit an object. Light can bounce back to your eye. Sometimes light hits a shiny surface. You see what was facing the surface. This is called a reflection. Mirrors make reflections.

Answer these questions

1. What is light?
2. Where does most light come from?
3. How fast does light travel?
4. What are rays?
5. What is radiant energy?
6. What is a reflection?
7. What do mirrors make?

* Additional Activity - Have students define underlined words.

Name _____

Light - Activity I

Answer these questions:

1. Is radiation visible or invisible?

2. Can radiation move through matter?

3. Are these transparent or opaque to visible light?

| | |
|---|---|
| a. paper | d. a tree |
| b. glass | e. a leaf |
| c. brick | f. a rock |

4. Do these give off natural or artificial light?

| | |
|---|---|
| a. fireflies | c. the sun |
| b. a flashlight | d. a lamp |

5. When you look in a mirror do you see a reflection or a refraction?

Name _____

Light - Lab Activity

Title: To see if light travels around corners.

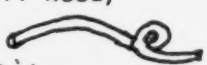
Purpose: Can light travel around corners?

Hypothesis: (Choose One)

A. Yes, light can travel around corners.

B. No, light cannot travel around corners.

Materials: (What you will need)

1. Rubber hose - 
2. Light bulb -

Procedure: (What to do)

1. Bend a piece of rubber tubing in the middle.
2. Point one end toward a light bulb.
3. Look into the other end.
4. Can you see the light bulb?
5. Straighten out the rubber hose.
6. Look into one end. Point the other end at the light bulb.
7. Can you see the light bulb?

Observation:

When could you see the light?

_____

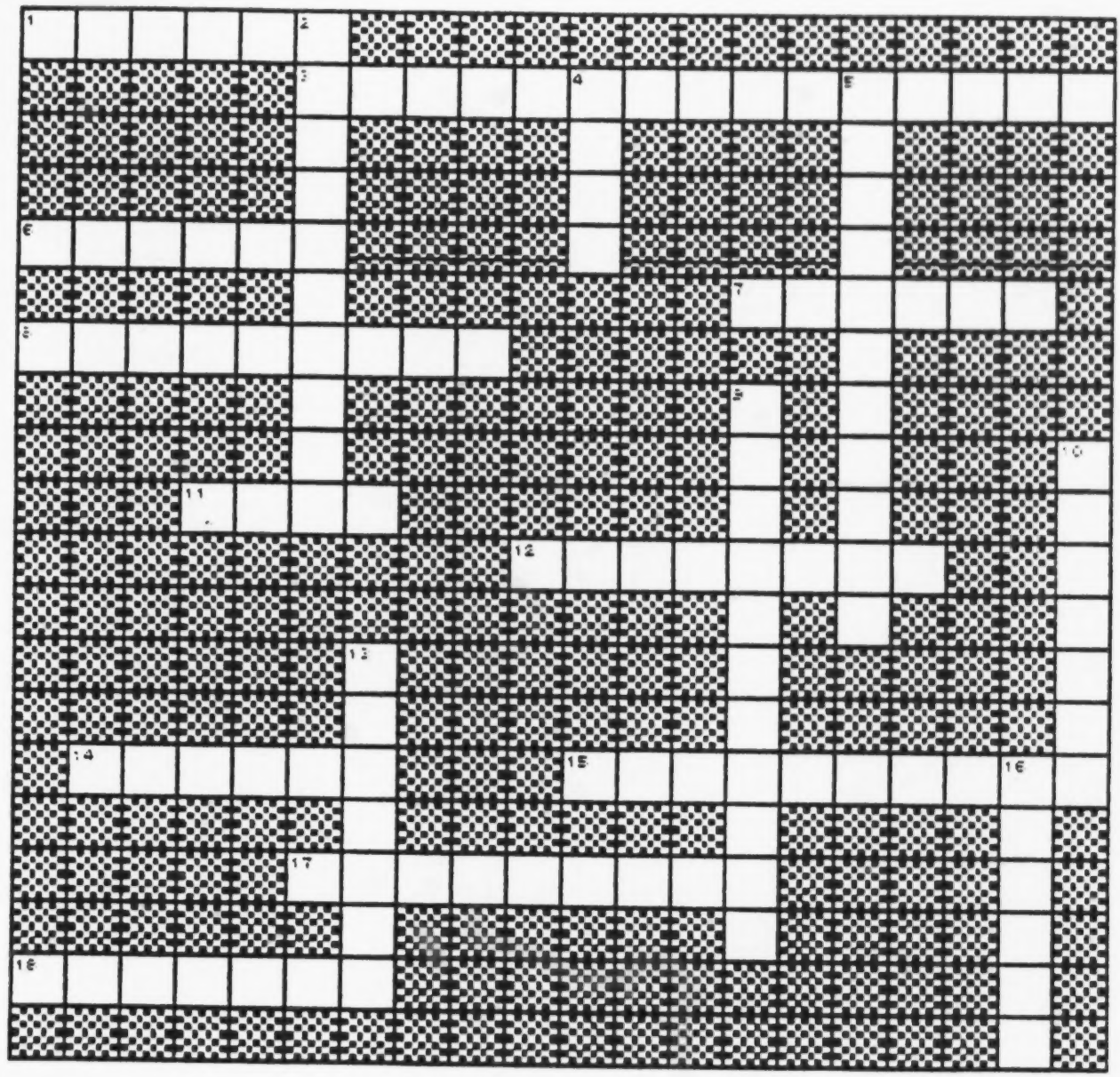
_____

Conclusion: (Was your hypothesis right?)

_____

_____

VOCABULARY ON LIGHT



ACROSS CLUES

1. A smooth surface that reflects light.
3. Type of wave that has radiant energy.
6. Light cannot pass through it.
7. To hit a surface and come back.
8. The line where something moves.
11. To be curved.
12. An object that gives off its own light.
14. Seems to be there.
15. Changing the direction of light by bending it.
17. The loss of energy in rays or waves
18. You can see it.

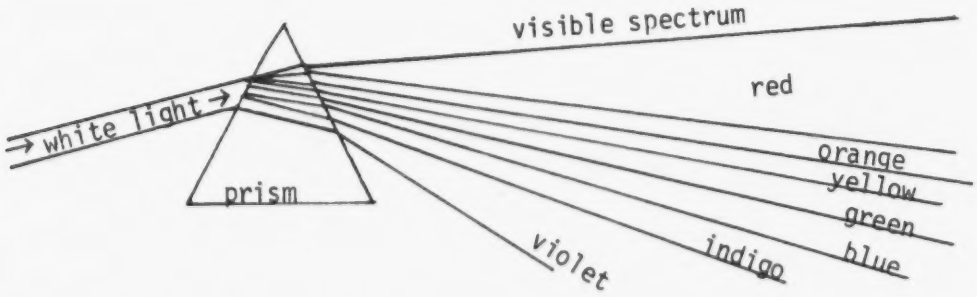
DOWN CLUES

2. Bouncing back.
4. Lines of light.
5. An object that does not give off its own light.
9. Light can pass through it.
10. A light or a lamp.
13. The outside of a thing.
16. Things.

COLOR

Facts to Know:

1. When anything is visible it can be seen.
2. White light is made up of light of many colors.
3. The light of many colors are called the visible spectrum.
4. The visible spectrum is made by sunlight.
5. The visible spectrum is a range of colors.
6. A rainbow is a visible light spectrum.
7. A rainbow has the following colors: Red, orange, yellow, green, blue, indigo, and violet.
8. A prism is made of glass or clear plastic.
9. A prism can break light rays into the colors of the rainbow.




10. The order of the colors in a rainbow never change.
11. Three colors of light - red, green, and blue - are called primary colors.
12. Different colors of light can be made by mixing these three primary colors.
13. Transparent object - An object so clear it can be seen through.
    - An object that all colors pass through.

    Example - drinking glass, window glass, plastic wrap.
14. Reflection - Bouncing back.
15. The color you see is the color bouncing back to your eyes from all of the colors of the visible spectrum. When you see a red apple, only the color red is reflected to your eyes.
16. Range of Color - Consists of the colors of the rainbow.

Name _____

Color - Activity I

Light comes in different colors. After a rain shower, we can sometimes see a rainbow. The white light from the sun is broken up into different colors. Seven colors can be seen. The seven colors of the rainbow are called the colors of the visible spectrum.

The colors can be seen when light shines through a prism. A prism is a piece of glass shaped like a triangle.

Light is refracted when it goes through a prism. As light passes through a prism, it is bent. Each color is bent differently. Red is bent the least. Violet is bent the most.

Answer these questions:

1. Does light come in different colors? _____
2. What can you see after a rain shower? _____
3. How many colors are in a rainbow? _____
4. What happens when light goes through a prism? _____

   _____

   _____
5. What is a prism? _____

   _____

Name _____

Color - Activity II

Complete the sentences:

_____ comes in different colors. After a rain shower, we can sometimes see a _____. The white light from the _____ is broken up into different colors. _____ colors can be seen. The seven colors of the rainbow are called the colors of the _____ _____.

The colors can be seen when light shines through a _____. A prism is a piece of _____ shaped like a triangle.

Light is _____ when it goes through a prism. As light passes through a prism, it is _____. Each color is bent differently. _____ is bent the least. _____ is bent the most.

Use these words to complete the sentences.

| | |
|---|---|
| rainbow | glass |
| visible spectrum | red |
| violet | bent |
| refracted | light |
| seven | sun |
| prism | |

Color - Lab

Title - To see the effects of colored glass on chalk.

Purpose - (Question) How will white chalk look through colored glass?

Hypothesis - (Answer question) - Choose one.

A. Yes, white chalk will be affected by colored glass.

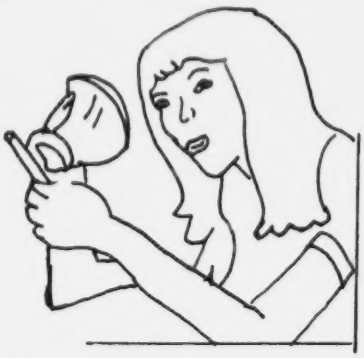
B. No, white chalk will not be affected by colored glass.

Materials - (What you will need)

1. One piece of chalk.
2. Several different colored pieces of glass. (red, blue, green yellow)

Procedure - (What to do)

1. Pick up a piece of white chalk.
2. Pick up one piece of colored glass.
3. Put the chalk behind the glass.
4. Observe how the chalk looks.



5. Look at the chalk through all the different pieces of colored glass.

Observation - (What you saw)

How did the chalk look behind each different color of glass?

_____

_____

What color did the chalk appear to be?

_____

Conclusion - Choose the correct answer then explain why.

A. My hypothesis is true.

B. My hypothesis is false.

# HEAT

Words to know:

1. Heat - A form of energy, different from light. Made by molecules in motion.

2. Temperature - Amount of heat we feel.

3. Conduction - The way heat moves through solids. The moving of heat from molecule to molecule until the whole object is hot.

   Examples of heat conduction materials - metals of iron, silver, copper and aluminum.

4. Convection - The way heat moves through liquids and gases.
   - The molecule closest to the heat gets hot first. It moves away from the heat. Cooler molecules take the space and get hot and move away.

   Example - The boiling of water.

5. Radiation - The way heat moves through empty space, a vacuum.

6. Calorie - A unit to measure heat.

7. Expand - To become larger.

8. Contract - To become smaller.

Heat Lab - Study - Conduction of Heat Through Solids

Title - To see if conduction takes place in solids.

Purpose - (Question) - Will conduction occur in an iron rod and a glass rod?

Hypothesis - (Answer a question)

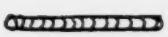
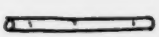
A. Yes, conduction will take place in a solid.

B. No, conduction will not take place in a solid.

Why? _____

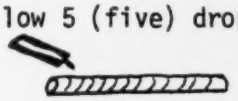
_____

Materials - (What you will use)

1. iron rod - 
2. glass rod - 
3. bunsen burner -
4. hot pad -
5. matches - 
6. safety goggles -
7. candle -
8. apron

Procedure - (What to do)

1. Put on safety goggles.
2. Put on lab apron.
3. Light the candle and the bunsen burner.
4. Allow 5 (five) drops of wax to fall on both rods.



5. Allow wax to cool for 2 minutes. Hold each rod with a hot pad.
6. Place the end of each rod into the bunsen burner flame.
7. Observe results.

Heat - Lab - (continued)

Observation - (What you saw) - Choose the correct answer.

A. The wax melted faster on the iron rod.

B. The wax melted faster on the glass rod.

c. The wax did not melt.

Conclusion - Choose the correct answer. Explain why.

A. Yes, my hypothesis is true.

B. No, my hypothesis is false.

Heat - Lab - Study of Convection of Heat Through Liquids

Title - To see if convection takes place in liquids.

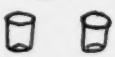
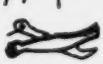
Purpose - (Question) - Will convection occur when water is heated?

Hypothesis - (Answer to question)

_____

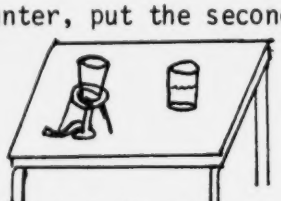
_____

Materials - (What you will need)

1. safety goggles -
2. two (2) beakers - 
3. food dye -
4. bunsen burner -
5. ring stand -
6. beaker tongs 

Procedure - (What to do)

1. Put on safety goggles.
2. Fill each beaker half way with cold water.
3. Put one beaker on the counter, put the second beaker on the ring stand.



4. Light the bunsen burner.
5. Put one drop of food dye into both beakers.
6. Observe what happens.

Observations - (What you saw)

What happened to the colored food dye in each beaker?

_____

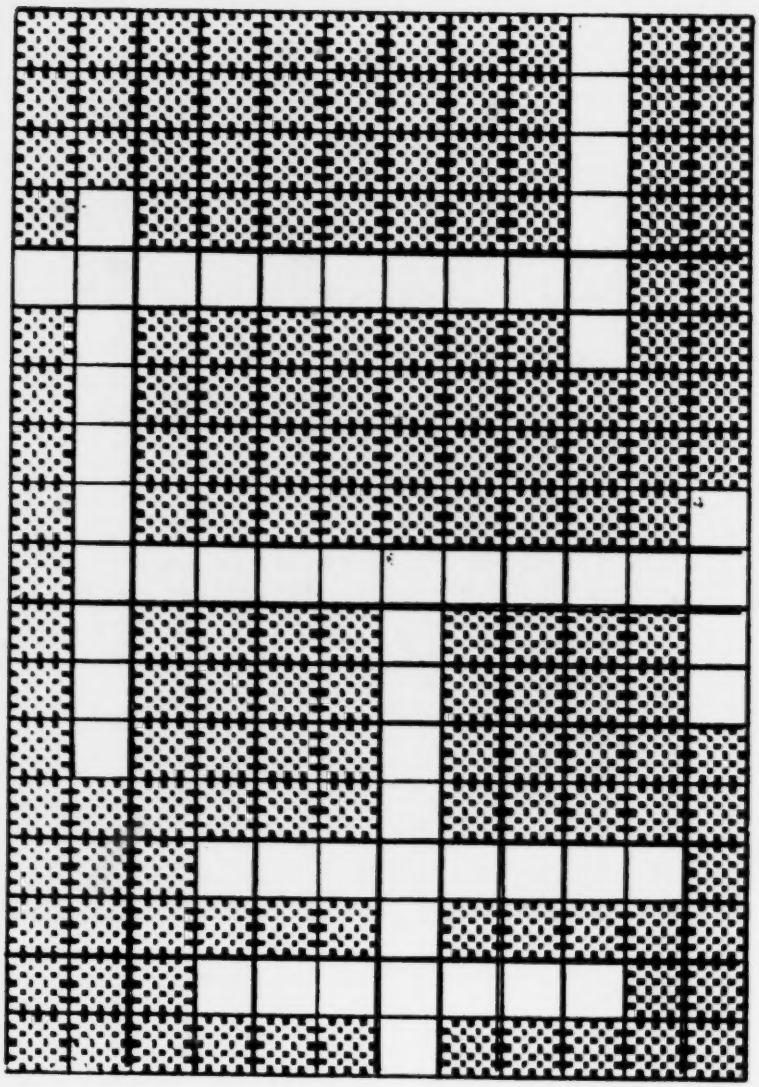
_____

Conclusion - Choose the correct answer, then explain.

A. Yes, my hypothesis is true.

B. No, my hypothesis is false.

VOCABULARY: HEAT



ACROSS CLUES

3. way heat moves through liquids and gases.
5. amount of heat we feel. Measured in centigrade or fahrenheit.
7. to become smaller.
8. a unit to measure heat.

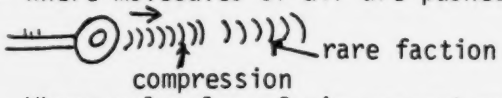
DOWN CLUES

1. to become larger.
2. the way heat moves through solids
4. a form of energy. made by molecules in motion.
6. way heat moves through space or a vacuum.

SOUND

Words to know:

1. Sound Wave - The movement of vibrations through the air.
2. Detected - Heard (past of - to hear)
3. Discover - Find out
4. Vibrate - To move back and forth (left to right, up and down) very fast.
5. Tiny - very small, little.
6. Particles - parts
7. Compressions - Where molecules of air are pushed together.




8. Rare faction - Where molecules of air are not pushed together.
9. Squeezed - pushed in
10. Frequency - The number of vibrations made in one second.
11. Decibels - The measurement used for the loudness of sound.
12. A fundamental tone - The lowest tone made by a string instrument.
13. Overtone - A tone higher than the fundamental tone.
14. Acoustics - The science of sound.
15. Interference - When two or more sound waves come together.
16. Tuning fork - A Y-shaped metal instrument that vibrates to make musical sounds.

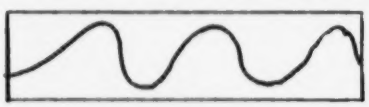
17. Pitch - How high or low a sound is.
18. Quality of sound - The number or loudness or overtones.

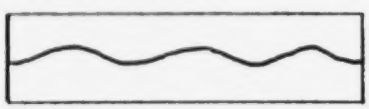
Name _____

Sound - Activity I

Sounds are caused by objects moving quickly back and forth. This rapid back and forth motion is called vibration. Touch your hand to your throat while you say your name. You can feel your throat vibrate. Sounds are made by vibrations.

Energy is needed to make sounds. Loud sounds have more energy than soft sounds. You use energy to make sounds when you talk. Loud sounds make patterns with large amplitudes.

loud sound  Large amplitude

soft sound  small amplitude

Answer these questions:

1. What are sounds caused by?

_____

2. What is a vibration?

_____

3. What is needed to make sounds?

_____

4. Which has more energy, loud or soft sounds?

_____

5. What kind of sound has large amplitudes?

_____

* Additional Activity - Define underlined words.

Name _____

Use these words to complete the sentences.

| | |
|---|---|
| vibrations | vibrate |
| throat | sounds |
| energy | quickly |
| amplitudes | loud |
| talk | smaller |
| more | soft |

_____ are caused by objects moving _____ back and forth. This rapid back and forth motion is called _____. Touch your hand to your _____ while you say your name. You can feel your throat _____. Sounds are made by vibrations.

_____ is needed to make sounds. _____ sounds have _____ energy than _____ sounds. You use energy to make sounds when you _____. Loud sounds make patterns with large _____. Softer sounds make patterns with _____ amplitudes.

Sound - Lab Activity

Title - To see if vibrations are needed to make sounds.

Purpose - Does a tuning fork vibrate when it is making a sound?

Hypothesis - (Choose one)

A. Yes, a tuning fork vibrates when it is making a sound.

B. No, a tuning fork does not vibrate when it is making a sound.

Materials - (What you will need)

1. a tuning fork -

2. a pan of water -

Procedure - (What to do)

1. Strike the tuning fork against the heel of your shoe.
2. Observe and record (write) what happens. = A. Observation
3. Strike the tuning fork again.
4. Place the forked end of the tuning fork in the pan of water.
5. Observe and record what happens. = B. Observation

Observation - (What happens)

A. _____

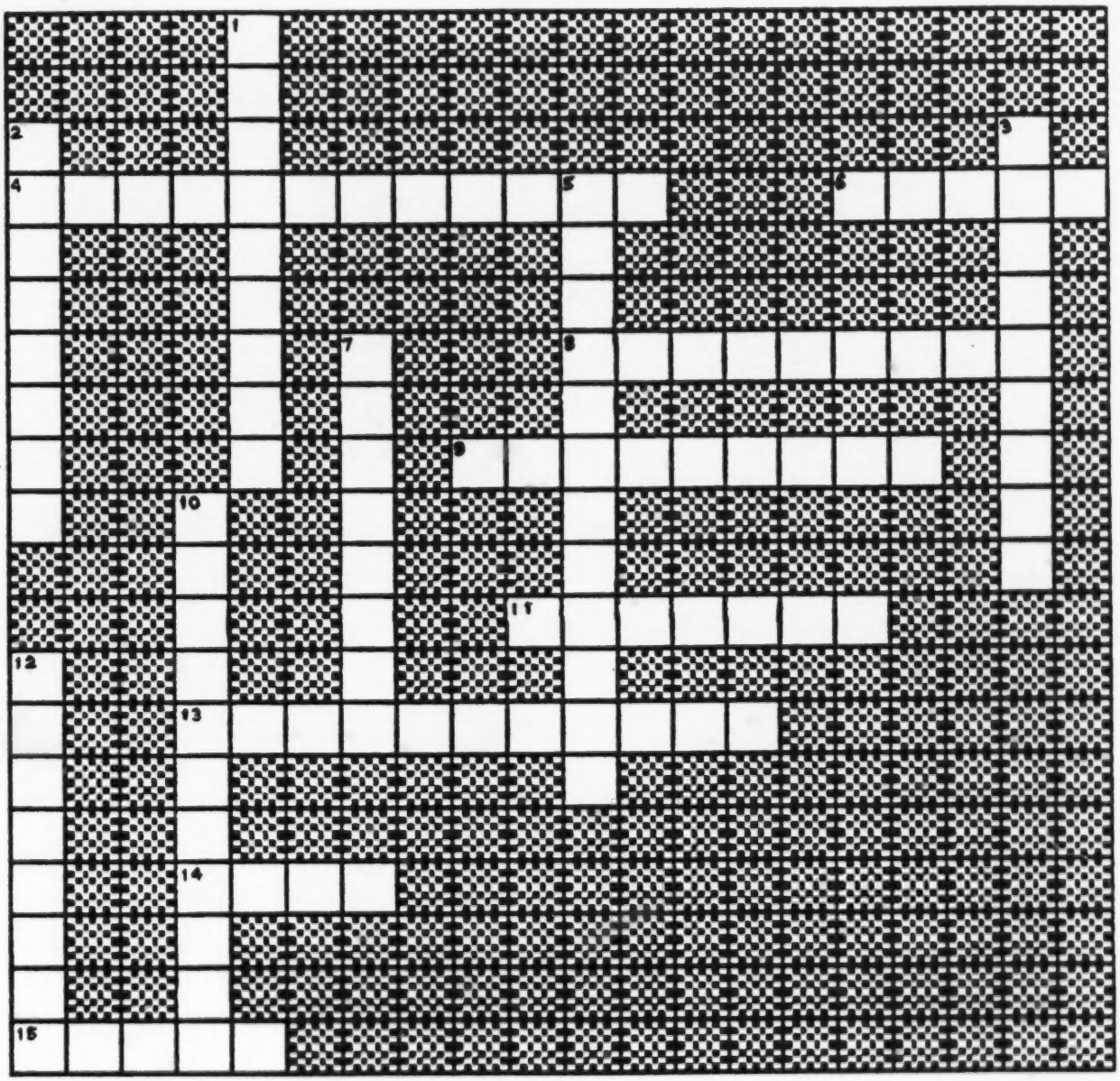
B. _____

Conclusion - (Answer the question to purpose)

_____

_____

VOCABULARY: SOUND



ACROSS CLUES

4. When two or more sound waves come together.
6. How high or low a sound is.
8. Parts. Usually very small.
9. The number of vibrations made in one second.
11. To move back and forth very fast.
13. The lowest tone made by a string.
14. Very small. Little.
15. Hearing the movement of vibration through the air.

DOWN CLUES

1. A tone higher than the fundamental tone
2. To find out.
3. The science of sound.
5. Where molecules of air are pushed together.
7. Pushed in.
10. Where molecules of air are not pushed together.
12. The measurement used for the loudness of sound.

MAGNETISM

Words to know:

1. Attract - when two things pull to each other
2. Repel - When two things push away from each other.
3. The lodestar - The north star.
4. A lodestone - a natural magnet that always points to the north star.
5. Magnetic Properties - Being able to attract iron and to face the same direction.
6. Artificial - Not natural.
7. Poles - The two ends of a bar magnet.

   Every magnet has a north and a south pole

   The poles are the strongest part of a magnet.

8. Magnetic Field - The area around a magnet.
9. Magnetic Lines of Force - Lines that show a picture of the magnetic field.
10. Imaginary - Made up; not real.
11. Not Visible - You cannot see it.
12. Permanent - Always, forever.

Magnetism - Activity I

Answer these questions:

1. Will a north pole and a south pole attract or repel?

2. Will two magnetic south poles attract or repel?

3. Is the lodestone a natural or artificial magnet?

4. What two poles do all magnets have?

5. Can a piece of iron be made into a magnet? How?

Magnetism - Lab Activity

Title - To see where a magnet is strongest.

Purpose - Where is a magnet strongest?

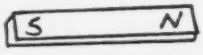
Hypothesis - (Choose one)

A. The whole magnet has the same magnetic strength throughout.

B. The poles of a magnet are strongest.

C. The middle of a magnet is strongest.

Materials - (What you will use)

1. a bar magnet - 


2. a box of paper clips -

Procedure - (What to do)

1. Lay the paper clips on your desk.

2. Hold the magnet in the middle.

3. Place the magnet on the paper clips.

4. Lift up.

5. Where are most of the paper clips?
   On the ends or in the middle?

Observation - (What happens)

Answer - Where are most of the paper clips?

Conclusion -

1. Where is a magnet the strongest?

2. Was your hypothesis true?

# ELECTRICITY

Words to know:

1. Attract - To pull something closer.
2. Repel - To push something away.
3. Charged - To have electric properties.
4. Property - Something special about a material.
5. Observation - What you see happen.
6. Positive - A (+) charge.
7. Negative - A (-) charge.
8. Positively charged - To have more (+) charges than (-) charges.
9. Negatively charged - To have more (-) charges than (+) charges.
10. Neutral - To have the same number of (+) charges and (-) charges.
11. Like Charges - The same charges
12. Unlike Charges - Not the same.
13. Conductor - Material that negative (-) charges can move through easily.

    Example: Copper wire, metals
14. Insulator - Material that negative (-) charges cannot move through easily.

    Example: Rubber, plastic
15. Current - The movement of negative charges through a wire.
16. Circuit - The path or wire that the electricity follows.
17. Dry Cell - A battery that keeps negative charges moving through a circuit.
18. Volt - The amount of 'push' that negative charges have.
19. Ampere - Amp - The amount of current in a circuit.
20. OHM - The amount of resistance in a circuit.
21. Watt - The rate electrical energy is used by a light or other appliance (stove, refrigerator, radio).
22. Excess - Extra
23. Shortage - Not enough

Name _____

Electricity - Activity I

Answer the following:

Are these pairs of charges positively (+) or negatively (-) charged or neutral?

1. 6 + charges and 3 - charges _____
2. 4 + charges and 4 - charges _____
3. 10 + charges and 12 - charges _____
4. 2 + charges and 5 - charges _____
5. 4 + charges and 7 - charges _____
6. 5 + charges and 5 - charges _____
7. 1 + charges and 8 - charges _____
8. 15 + charges and 7 - charges _____
9. 9 + charges and 9 - charges _____
10. 3 + charges and 2 - charges _____

Name _____

Electricity - Activity II

Are these statements True or False?

1. Negative charges can move from one object to another. _____
2. Positive charges can move from one object to another. _____
3. Positive charges cannot move from one object to another. _____
4. Two positive charges will not attract. _____
5. A positive charge and a negative charge will attract. _____
6. Metal is a good conductor. _____
7. Rubber is a good conductor. _____
8. An insulator is a material like rubber - that charges cannot easily move through. _____

Electricity - Activity

Are these conductors or insulators? Write the correct word on the line.

1. A pair of rubber boots. _____
2. A key _____
3. A pencil eraser _____
4. A soup can _____
5. A metal wire _____
6. A wooden spoon _____
7. A metal fork _____
8. Plastic pot handle _____

Electricity - Circuits Word Search

U L J G E M Q U Y P O I P B K V N F W J U I B B M
M F V V D X C Y U Y K O G K O K U M G X E S M J E
I H U T B E F O E A J S L L K Q U T O P T F T L O
H H T M C F U Y H T I C T B E I F H A T R C S T Z
G X R P I P U L F N P S Z Z S A K T A G E G F U I
T H W I G T A Q I E S Y P Q C E R W B S T W T U U
O L D R C U I H E R I I S H O R T A G E E C T D S
Q Z R G I K Q Q B R D Y I U S O Z T W W M J Y Q P
H W M Q B O Y V B U W C C Y T N K T I T M J T Y M
V U F Y Y Z D Z I C Y I M M W U P F F S A O O J A
K V R R D R Y - C E L L S X T Q B H E B V B F M G
B F E X V I K X U S Q J W S V D O W E V M G P A A
U A T X Q G W C A A G V H S V W P G K X B K E S D
D F E W D N V M R G Y T I C I R T C E L E G E X X
V X M J D D T W E L T F M E D J X H U T A X O W O
F B T V E K M E R E P M A B L C W C J T C K S L E
B H L G W P N X G K U M J E G I G N L E N Z M W K
B T O X C L M D E H U H T N W N E O S X R W H W G
P M V W T W S L G H Z K I R X Y V S R J H G O K X
P O T R E M P H J V M K U B Q B T S U A Y B Y P A
Z N W T C H G D M E N H C C J W Z G Z O Q F T I A
L F C V H N T C I N B S R Z R E S I S T A N C E O
V R E O O T U F I W B F I Q K D F V V K A J O R Z
B S A A A A E B A L B R C I Y S P K A H V S T O H
I G M V Z F H U Z W Z T P S H M U V B G S R A R S

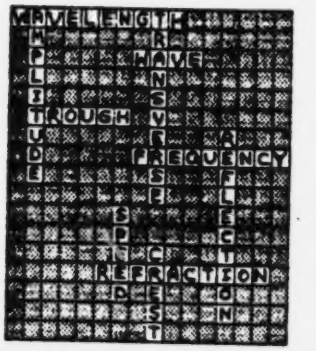
WORDS

| | | |
|---|---|---|
| CURRENT | CIRCUIT | EXCESS |
| SHORTAGE | DRY - CELL | VOLTS |
| VOLTAGE | AMPERE | AMPS |
| OHMS | WATTS | VOLTMETER |
| AMMETER | RESISTANCE | ELECTRICITY |

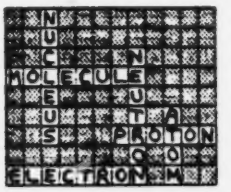
Answer Keys to Crossword Puzzles

ANSWERS: TYPES OF MATTER

ANSWERS: WAVE THEORY

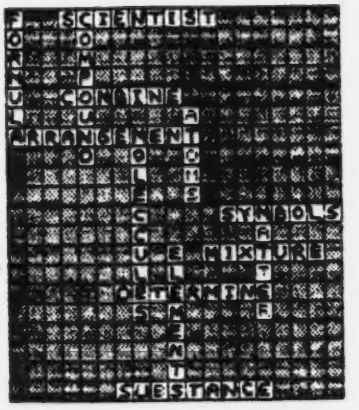



ANSWERS: VOCABULARY ON ATOMS




ANSWERS: VOCABULARY ON LIGHT

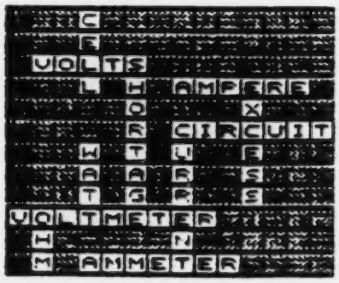
ANSWERS: VOCABULARY: ELEMENTS



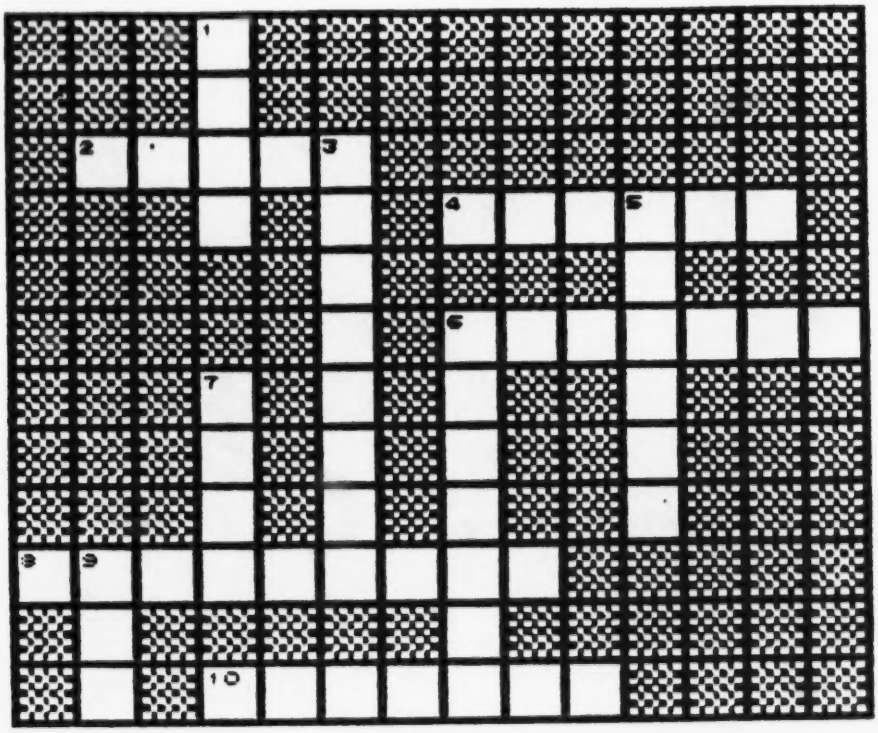

ANSWERS: VOCABULARY ON HEAT

ANSWERS: VOCABULARY OF SOUND

ANSWERS: ELECTRICITY-CIRCUITS



ELECTRICITY-CIRCUITS



ACROSS CLUES

2. The amount of "push" that negative charges have is called _____ .
4. The amount of current in a circuit is the _____.
6. The path or wire that electricity follows is called a _____.
8. A thing that measures the amount of voltage in a circuit is a _____.
10. A thing that measures the amount of current in a circuit is called a _____.

DOWN CLUES

1. A battery that moves negative charges along a circuit is a dry_____.
3. This word means there is not enough of something.
5. This work means there is extra, too many, of something.
6. The movement of negative charges in a wire is called the _____.
7. A _____ is the rate electrical energy is used by a light or a toaster or other appliance.
9. The amount of resistance in a circuit is called _____.

UNIT IV

PHYSICS

# PHYSICS

The materials in this section of the guide present teachers with a variety of techniques with which to aid ESOL students.

Units covered in the Physic's Section:

A. Force

B. Newton's Law of Gravitation

C. Motion

D. Work

E. Power

F. Machines

G. Simple Machines

Force

Words to Know:

1. Force - Any push or pull on an object.
2. Push - To press against so as to move away.
3. Pull - To use force so as to move something closer.
4. Lift - To make higher, raise.
5. Opposite - Different, directly facing or back to back.
6. Strong - Having great force or power.
7. Equal - Of the same amount of size.
8. Balanced - Equal in amount, size or weight between two things.
9. Unbalanced - Not equal between two things.
10. Movement - The act of moving.
11. Gravity - Force that pulls object toward their center. Weight.
12. Newton - The unit of measurement of force.

Name _____

Force - Activity I

Define the underlined words.

A force is any push or pull on an object. A force can start an object moving. (A boy pushing a cart.) A force can stop a moving object. (The brakes stopping a bus.) A force can change direction of a motion. (Hitting a ball with a bat.)

Pulling is a force. Lift a box off the floor. You pull it up. A tug of war happens when two groups each pull in opposite directions. The group with the stronger force wins.

All pushes are examples of forces. A push is a force when you sit in a chair, you push down on the chair.

When forces are not equal (unbalanced) the stronger force wins and the object will move. When forces are equal (balanced) movement is stopped, nothing moves.

Answer these questions.

1. What is the push or pull on an object?

2. What are two things forces can do?

3. Give an example of pulling.

4. Give an example of pushing.

5. What is it when forces are not equal?

6. What group will win in a tug of war?

7. When does nothing move?

Name _____

Force - Activity II

Complete the sentences using these words:

| | |
|---|---|
| direction | stop |
| stopped | force |
| move | equal |
| pulling | lift |
| opposite | stronger |
| pushes | stronger |

_____ is any push or pull on an object. A force can start an object moving. A force can _____a moving object. A force can change _____ of a motion.

_____ is a force. _____ a box off the floor. You pull it up. A tug of war happens when two groups pull in _____ directions. The group with the _____ force wins.

All _____ are examples of forces. A push is a force when you sit in a chair, you push down on the chair.

When forces are not equal, the _____ force wins, and the object will _____. When forces are _____, movement is _____, nothing moves.

Name _____

Force - Newton's Law of Gravitation - Activity III

All objects pull on one another. This pull of force is gravity. Gravity pulls all matter toward the ground. It is gravity that makes tree leaves fall to the ground.

If it was not for gravity, a ball thrown into the air would keep on moving. Gravity makes things have weight.

All of the planets have gravity. So does the sun. The sun's gravity keeps the planets in their orbits. The larger the mass of an object, the greater the pull of gravity it has on smaller objects.

Sir Isaac Newton was the first person to explain falling objects as the result of a force.

Answer these questions:

1. What keeps things on the earth?

2. What makes leaves fall to the ground?

3. What does gravity make things have?

4. Where does gravity pull all matter?

5. What keeps planets in their orbits?

6. How does mass determine gravity?

7. Who was Sir Isaac Newton?

Name _____

Gravity - Activity IV

Complete the sentences using these words:

| | |
|---|---|
| force | fall |
| pull | matter |
| moving | weight |
| Newton | gravity |
| planets | sun |
| smaller | orbits |
| mass | greater |

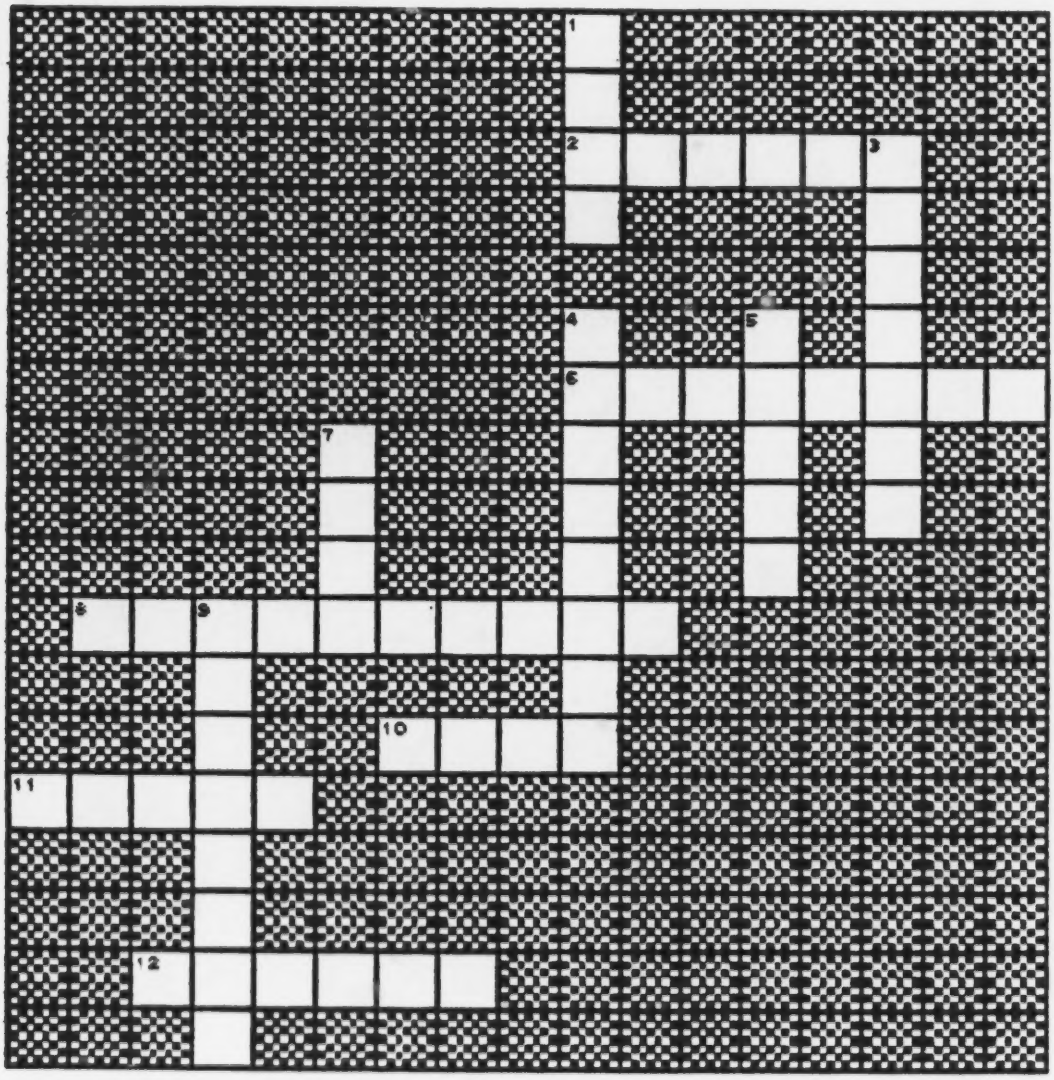
All objects _____ on one another. This pull of force is _____. Gravity pulls all _____ towards the ground. It is gravity that makes tree leaves _____ to the ground.

If it was not for gravity, a ball thrown into the air would keep _____. Gravity makes things have _____.

All of the _____ have gravity. So does the _____. The sun's gravity keeps the planets in their _____. The larger the _____ of an object, the _____ the pull of gravity it has on _____ object.

Sir Isaac _____ was the first person to explain falling objects as the result of _____.

VOCABULARY: FORCE



ACROSS CLUES

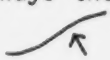
2. Having great force or power.
6. Different, directly facing or back to back.
8. Not equal between two things.
10. To make higher.
11. Of the same amount or size.
12. The unit of measurement of force.

DOWN CLUES

1. To press against so as to move away.
3. Force that pulls an object toward their center.
4. The act of moving.
5. Any push or pull on an object.
7. To use force so as to move something closer.
9. Equal in amount, size or weight between two things.

# MOTION

Words to Know:

1. Motion - A change of location or position. (Example - Going from sitting to standing is motion.)
2. Distance - How far something is.
3. Time - How long it moves.
4. Speed - How fast something moves = rate of motion.
5. Constant - Something that is always the same.
6. Slope - An angle, like a hill. 
7. Force - A push or pull on a thing.
8. Friction - A force from two things rubbing together.
9. Unbalanced forces - The push is stronger than the pull or the pull is stronger than the push - unequal.
10. Inertia - An object will not change its motion unless unbalanced forces act on it.
11. A reaction - An action or motion in the opposite direction as the first action and is equal.
12. Attraction - A pulling of one thing to another.
13. Acceleration - Moving faster and faster.
14. Terminal Speed - Acceleration stops and the speed is constant.

Name _____

Motion - Activity I

Answer these questions:

1. What is motion?

2. Underline the words that show a motion.

| | | |
|---|---|---|
| a. walking | d. cooking | g. reading |
| b. thinking | e. sitting | h. jogging |
| c. running | f. falling | i. standing |

Look at the data. Graph the following data.

| Time (seconds) | Distance (Meters) | | |
|---|---|---|---|
| | Car A | Car B | Car C |
| 0 | 0 | 0 | 0 |
| 1 | 4 | 1 | 2 |
| 2 | 8 | 3 | 4 |
| 3 | 12 | 8 | 6 |
| 4 | 16 | 10 | 8 |
| 5 | 20 | 14 | 10 |
| 6 | 24 | 14 | 12 |

Answer these questions:

3. What is the time measured in? (minutes, seconds, hours)

4. What distance (how far) can Car B go in 3 seconds?
   A. 12 B. 8 C. 6

5. Which car can travel 20 meters in 5 seconds?
   A. Car A B. Car B C. Car C

6. Which car goes a longer distance in 8 seconds?

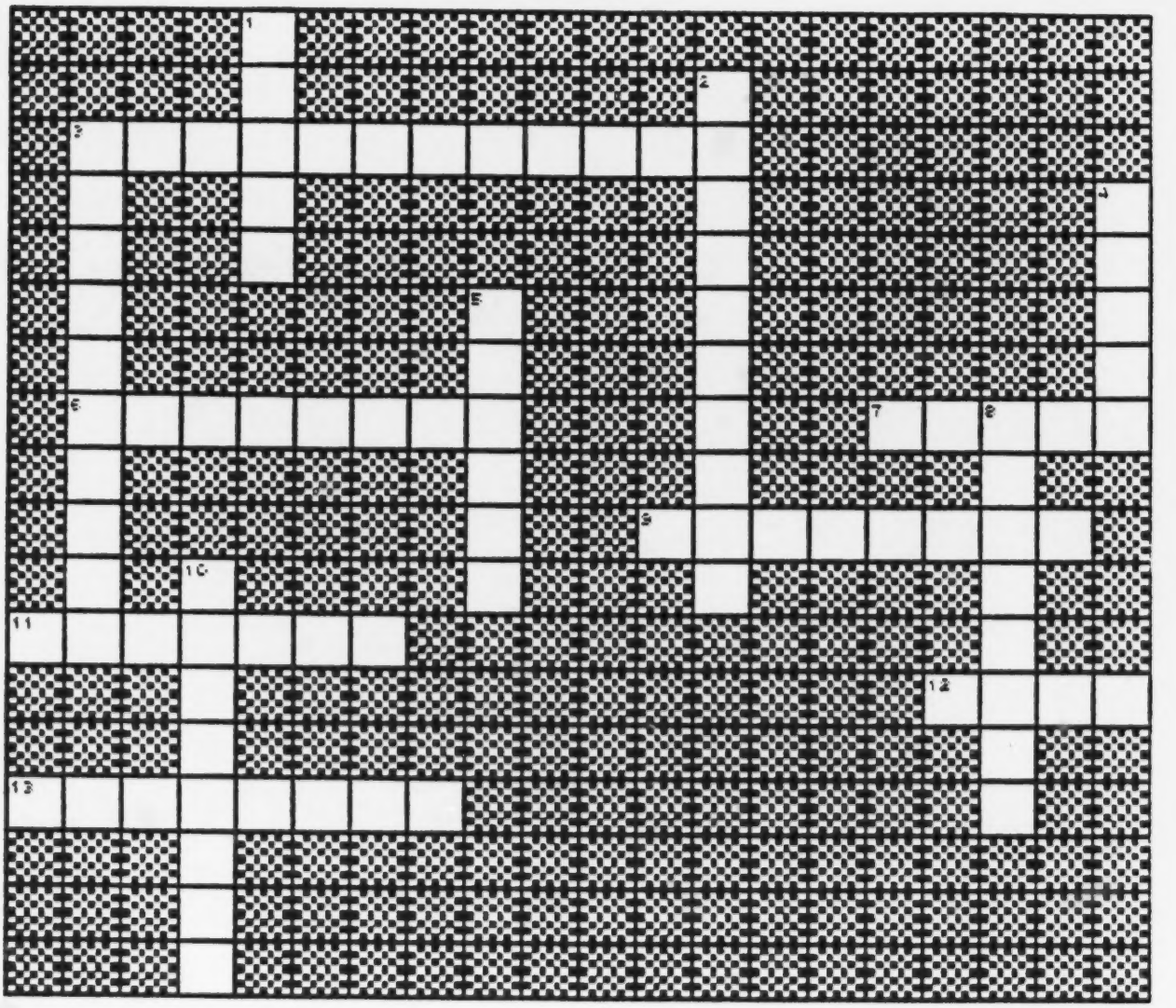
7. Which car always goes the shortest distance?

8. Which car goes fastest?

9. Which car goes slowest?

10. Which car did not have a constant speed?

VOCABULARY ON MOTION



ACROSS CLUES

3. Moving faster and faster.
6. Something that is always the same
7. A push or a pull on a thing.
9. Speed when acceleration stops and the speed is constant.
11. An object will not change its motion unless unbalanced forces act on it.
12. How long it moves.
13. How far something is.

DOWN CLUES

1. How fast something moves = rate of motion.
2. Force when the push is stronger than the pull or the pull is stronger than the push.
3. A pulling of one thing to another
4. An angle, a hill.
5. A change of location or position.
8. An action or motion in the opposite direction.
10. A force from two things rubbing together.

Name _____

Work - Activity I

The term work is important. Scientists say that work is done only if something is moved. Throwing a ball is work because you moved a ball and your body. Standing still holding your books is not work because you did not move.

Force is the pushing or pulling done by work. For work to be done, two things are needed. One is, there must be a force. And second, the force must move something. If there is no movement, no work is done.

A simple formula to help figure how much work is done:

| Work | = | Force | x | Distance |
|---|---|---|---|---|
| W | = | F | x | D |

Complete:

The term _____ is important. Scientists say that _____ ___ _____ only if something is _____. Throwing a ball is _____ only if something is _____ . Standing still holding your books is not _____ because _____.

Force is the _____. For work to be done, _____. One is _____. And second, _____. If there is no movement, _____.

A simple formula to _____.

W = _____ x _____

Name_____

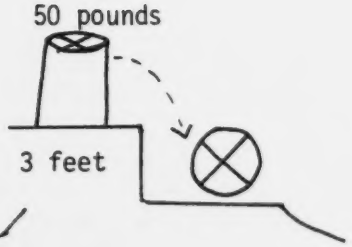
Work - Activity II

Scientific Work = Force x Distance
W = F x D

Find the amount of work done.

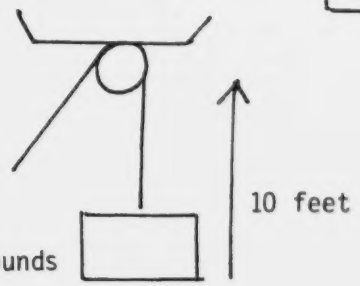
1. W = F x D

_____ = 50 grams x 3 meters

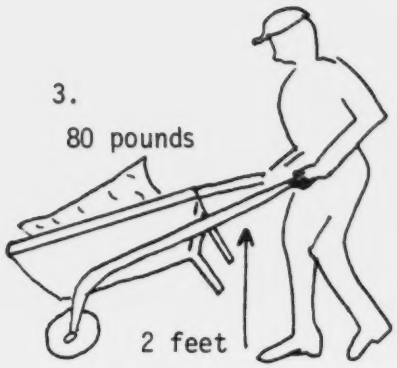



2. F x D = Work

_____ x _____ = _____

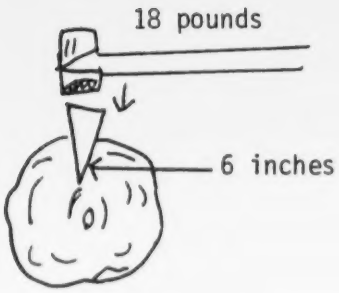



3.




3. F x D = Work

_____ x _____ = _____



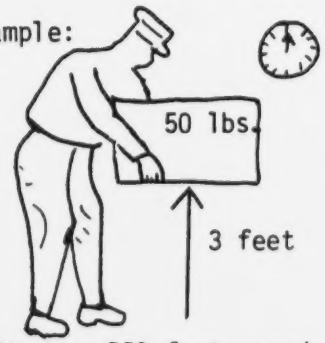

Scientific Work is expressed in the unit of Foot - Pounds.

Work

Power - The rate of doing work

$$= \frac{\text{Work (Force x Distance)}}{\text{Time}}$$

Example:




$$\text{Power} = \frac{\text{Work}}{\text{time}}$$

$$= \frac{50 \text{ lbs} \times 3 \text{ feet}}{1 \text{ second}}$$

Power = 150 ft. lbs./second

Horse Power = 550 foot pounds per second

$$\text{Horse Power} = \frac{\text{Power}}{550 \text{ ft. lb per second}}$$

# MACHINES

Words to Know:

1. Describe - To tell about something. I can describe John. He is tan and thin.
2. Simple Machines - A machine with a few (1 or 2) moving parts. A hammer is a simple machine.
3. Decrease - Become less or smaller. When it is cold the temperature decreases.
4. Increases - Become more or bigger. When it is hot the temperature increases.
5. Force - Some kind of push or pull.
6. Friction - The force made when two surfaces rub together. When you rub your hands together the friction makes your hand feel hot.
7. Mechanical Advantage - The increase in force made by using a machine.
8. Effort - Force used on a machine; work.
9. Resistance - The force a machine overcomes.
10. Machine - A device which is used to:
    A. Change the direction of a force,
    B. Change the amount of force, or
    C. Change the distance and speed.

Name _____

Machines - Activity I

Facts to Know:

1. A simple machine has a few (1 or more) moving parts.
   Which of these are simple machines? (Write yes or no)

   A. A typewriter = _____

   B. A hammer = _____

   C. A car = _____

   D. A television = _____

   E. A key = _____

   F. A pen = _____

   G. A refrigerator = _____

   H. A broom = _____

   I. A telephone = _____

   J. A baseball bat = _____

2. Machines can:
   - change the direction of a force (pulley).
   - increase a force (bottle opener).
   - increase the distance and speed of a force (fishing pole).

3. Machines can increase the force put into them. (Think of driving a car).

4. Machines cannot increase the work put into them.

5. List five (5) machines not mentioned above.

   A. _____

   B. _____

   C. _____

   D. _____

   E. _____

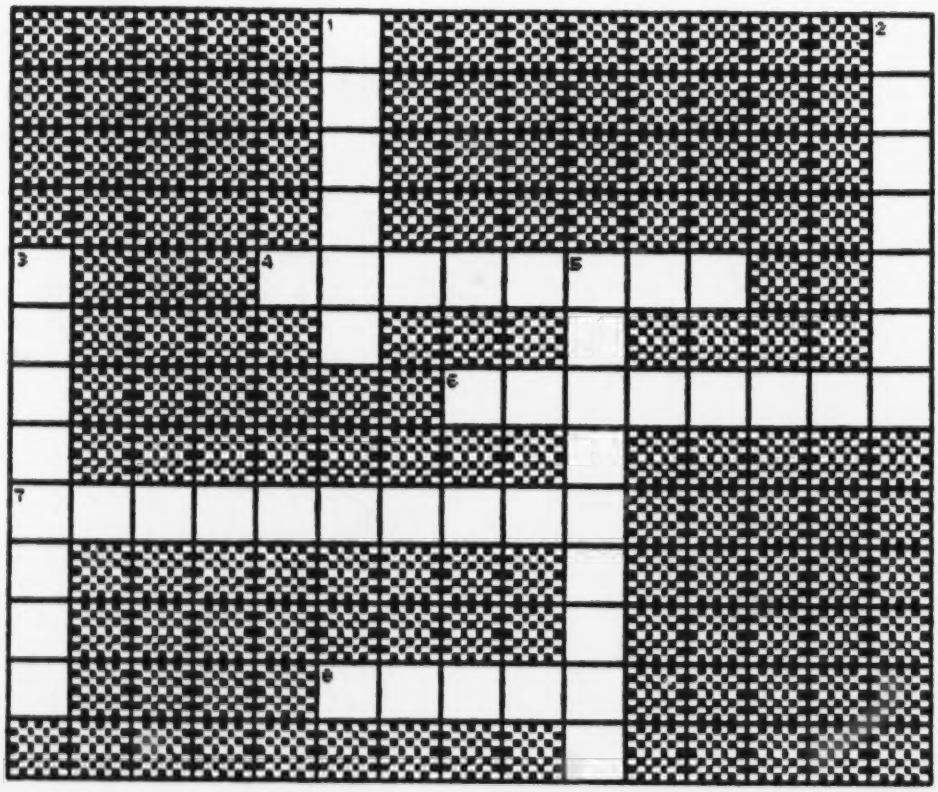
Name _____

Machines - Activity II

Matching: Write the letter next to the number.

| | |
|---|---|
| _____ 1. decrease | A. a push or a pull |
| _____ 2. increase | B. making bigger |
| _____ 3. friction | C. something with few parts |
| _____ 4. describe | D. to tell about |
| _____ 5. a simple machine | E. the force made by two surfaces rubbing together |
| _____ 6. force | F. make smaller |
| _____ 7. effort | G. force used on a machine |
| _____ 8. resistance | H. the force a machine works against |
| _____ 9. mechanical advantage | I. increase in a force by using a machine |

VOCABULARY: MACHINES



ACROSS CLUES

4. the force made when two surfaces rub together.
6. become less or smaller
7. the force the machine overcomes.
8. some kind of push or pull.

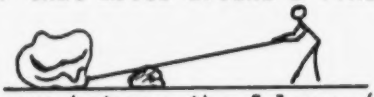
DOWN CLUES

1. force used on a machine: work.
2. a device which is used to change the direction, the amount, or the direction and speed of the force.
3. to tell about something.
5. become more or bigger.

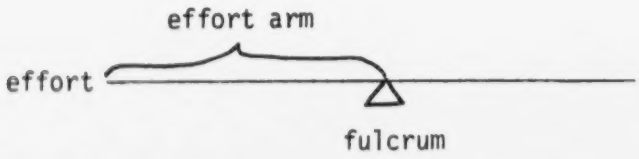
SIMPLE MACHINES

Words to Know:

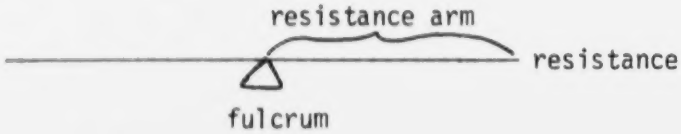
1. Fulcrum - A fixed point . . . a point that does not move.
2. Lever - A straight bar that moves around a fixed point (fulcrum).



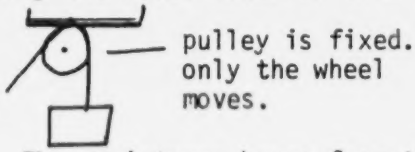
3. Effort Arm - The distance between the fulcrum (fixed point) and the effort.



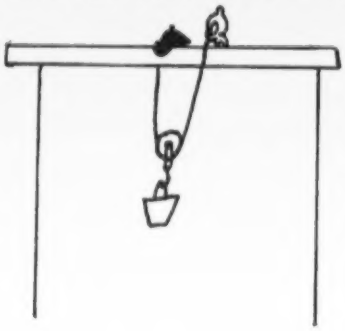

4. Resistance Arm - The distance between the resistance and the fulcrum.




5. Pulley - A machine with a wheel that is used as a lever.
6. A Fixed Pulley - Only the wheel moves on this type of pulley.




7. A Movable Pulley - The resistance hangs from the center (middle) of the pulley and resistance move together.

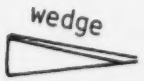


8. Gear - A wheel with teeth around the outside.

9. Axle - A rod fastened to a movable wheel.

10. Inclined Plane - A surface where one end is higher than the other.

11. Wedge - An inclined plane that is thicker (fatter) at one end than the other.




a wedge of cheese

12. Screw - An inclined plane that goes around a rod.

SIMPLE MACHINES

Facts to Know:

1. To find the mechanical advantage of a lever, you divide (÷) the length of the effort arm by the length of the resistance arm.

$$\frac{\text{length of effort arm}}{\text{length of resistance arm}} = \text{mechanical advantage}$$

2. First (1st) class levers can change the direction of the force. Second (2nd) class and third (3rd) class levers cannot change the direction of the force.

3. The mechanical advantage of a fixed pulley is 1. The mechanical advantage of a movable pulley is 2.

4. Gears, inclined planes, wedges, and screws are all kinds of levers.

5. Inclined planes are used to move objects (things) from one level to a higher level.

6. To find the mechanical advantage of an inclined plane divide (÷) the distance an object moves (effort distance) by the highest point height of the inclined plane, (resistance distance).

$$\frac{\text{effort distance}}{\text{resistance distance}} = \text{mechanical advantage}$$

resistance distance

Name_____

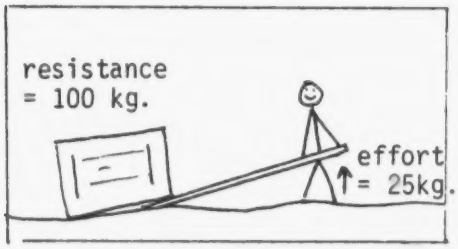
Simple Machines - Activity I

Find the mechanical advantages of the following:

1. The resistance is _____ kg.
2. The force (effort) is _____ kg.
3. The mechanical advantage is

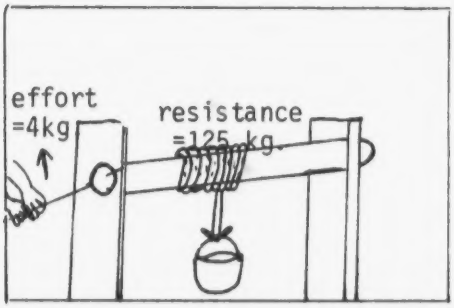
   _____.

(Mechanical advantage = $\frac{\text{resistance}}{\text{effort}}$ )



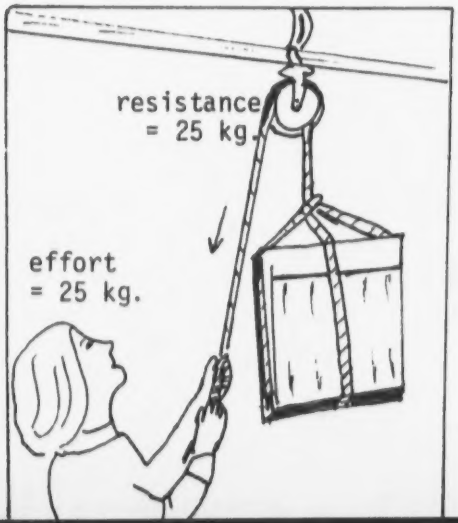

4. The resistance is _____ kg.
5. The force (effort)is _____ kg.
6. Mechanical advantage is

   _____.




7. The resistance is _____ kg.
8. The force (effort) is _____ kg.
9. The mechanical advantage is

   _____.



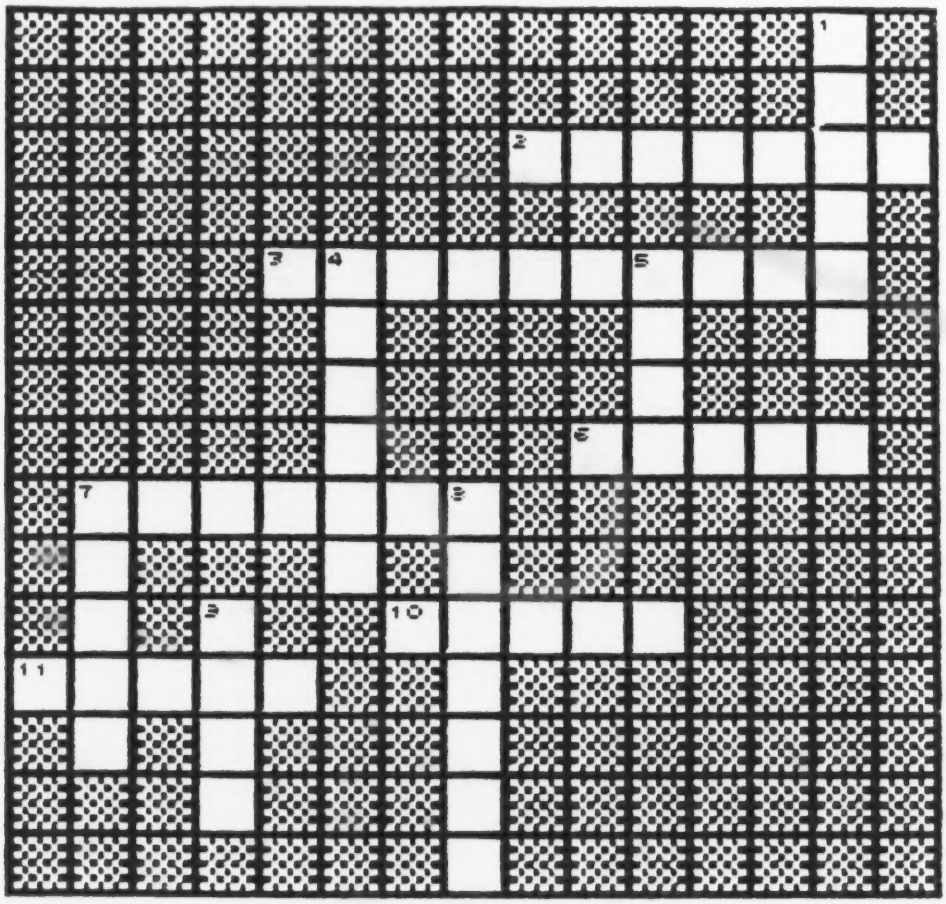

10. The resistance is _____ kg.
11. The force (effort) is _____ kg.
12. Is this machine multiplying the

    the force? _____
13. The mechanical advantage is .

    _____.
14. What useful job is this machine doing?

    _____.

Simple Machines - Use Your Vocabulary Words.



ACROSS CLUES

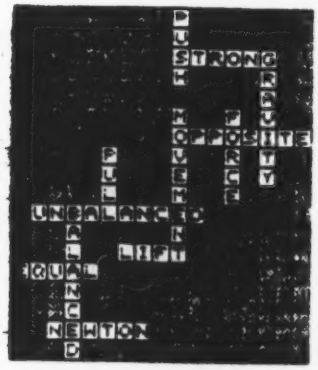
2. A word that means able to move.
3. The distance between the resistance and the fulcrum is the _____ arm.
6. An inclined plane that is thicker at one end than the other.
7. A fixed point . . . a point that doesn't move.
10. An inclined plane wrapped around a rod.
11. A straight bar that moves around a fixed point.

DOWN CLUES

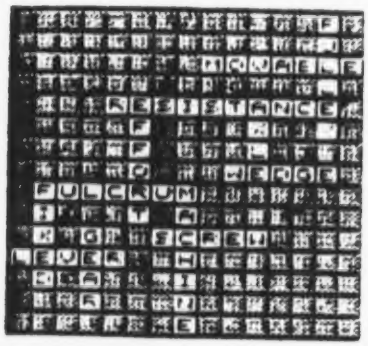
1. A machine with a wheel that is used as a lever.
4. The distance between the fulcrum and the effort is the _____ arm.
5. A rod fastened to a movable wheel
7. Not movable.
8. A hammer is a simple _____.
9. A wheel with teeth around the outside.

Answer Keys to Crossword Puzzles

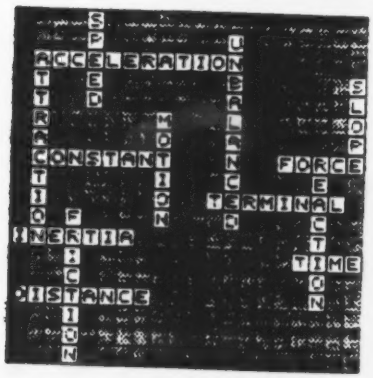
ANSWERS: VOCABULARY ON FORCE



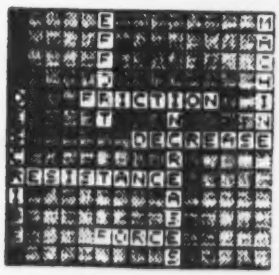

ANSWERS: SIMPLE MACHINES



ANSWERS: VOCABULARY ON MOTION




ANSWERS: VOCABULARY: MACHINES



EVALUATION OF THIS CURRICULUM GUIDE

This form is to be used by individual teachers to provide a reaction to the curriculum guide currently being used. At the end of each unit taught or after teaching from the entire document, please complete the form and send it to Assistant in Curriculum and Instruction, Department of Instructional Services. Your input is necessary in order to assess what revisions must be made in the document. Thank you for helping to review and revise your curriculum so that it is meaningful to your teaching.

- - - -

8. Did the format of the guide make it easy to use? Yes _____ No _____ What changes would you like to see included?

_____

_____

_____

9. Do the lessons contain realistic teaching time frames? Yes _____ No _____
If no, what should be changed?

_____

_____

10. Are there a sufficient number of teaching lessons/activities? Yes _____ No _____

11. Are there a sufficient number of available resources listed? Yes _____ No _____

12. Was the content appropriate for the level of teaching? Yes _____ No _____

13. Does the content adequately provide for Title IX (sex equality) guidelines?
Yes _____ No _____

14. Does the content adequately provide for inclusion of information about multicultural and multiracial relationships? Yes _____ No _____

15. The following suggestions would improve this document:

_____

_____

_____

_____

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Name (if desired) _____

School _____